Communication Manual
Fusion4

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CHAPTER 1 GENERAL

1.1 Introduction

The Fusion4 Communication Manual provides you with the information needed to automate the control and data retrieval process from Honeywell Enraf microprocessor-based controllers and Fusion4 Portal.

This manual describes the machine-to-machine messages needed for electronic controller operation using a number of protocols. By providing the protocols as defined in this manual, you can choose the protocol that best suits your needs.

This manual applies to Fusion4 Portal and all Fusion4 controllers.

The list of controllers includes:

- Fusion4 SSC-A (Single Stream Controller for Additive Injection)
- Fusion4 SSC-B (Single Stream Controller for Blending)
- Fusion4 MSC-A (Multi-Stream Controller for Additive Injection)
- Fusion4 MSC-L (Multi-Stream Controller for Loading) (future implementation)

1.2 Target Group

This manual is intended for:

- Administrators who are assigned to install Fusion4 controllers and/or Fusion4 Portal.
- Administrators, engineers, system integrators and supervisors who are assigned to configure and maintain Fusion4 controllers and/or Fusion4 Portal.
- System integrators who are assigned to integrate the Terminal Automation System (TAS) with Fusion4 controllers and/or Fusion4 Portal.
- Operators who are assigned to operate Fusion4 controllers and/or Fusion4 Portal.

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CHAPTER 2 SAFETY

2.1 Safety Conventions

2.1.1 Warnings

Following warning mark is used within this document to urge attention in order ***to prevent personal injuries*** or dangerous situations, further described within this document.

Symbol	Description	Remark
	General warning	Will always be explained by text.

2.1.2 Cautions

Following caution mark is used within this document to urge attention in order ***to prevent damages to the equipment***, further described within this document.

Symbol	Description
	General caution sign

2.2 Liability

The information in this installation & operation manual is the copyright property of Honeywell International Inc. Honeywell International Inc. disclaims any responsibility for personal injury or damage to equipment caused by:

- Deviation from any of the prescribed procedures
- Execution of activities that are not prescribed
- Neglect of the safety regulations for handling tools and use of electricity

The contents, descriptions, and specifications in this manual are subject to change without notice. Honeywell International Inc. accepts no responsibility for any errors that may appear in this manual.

WARNING! Only personnel that are authorized by the customer are allowed to make changes on the Fusion4 system. All modifications must be in accordance to the guidelines as set forth by Honeywell International Inc.

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CHAPTER 3 FUSION4 SYSTEM OVERVIEW

Honeywell Enraf's Fusion4 loading automation system manages and controls the loading and unloading of petrochemicals in a safe, secure and well-documented manner. Key elements in the Fusion4 system are:

- Fusion4 Portal, see section 3.1
- Fusion4 controllers for loading, see section 3.5
- Fusion4 controllers for additive injection, see section 3.2 and section 3.4
- Fusion4 controllers for blending, see section 3.3

FIGURE 3-1 shows an overview of the Fusion4 system.

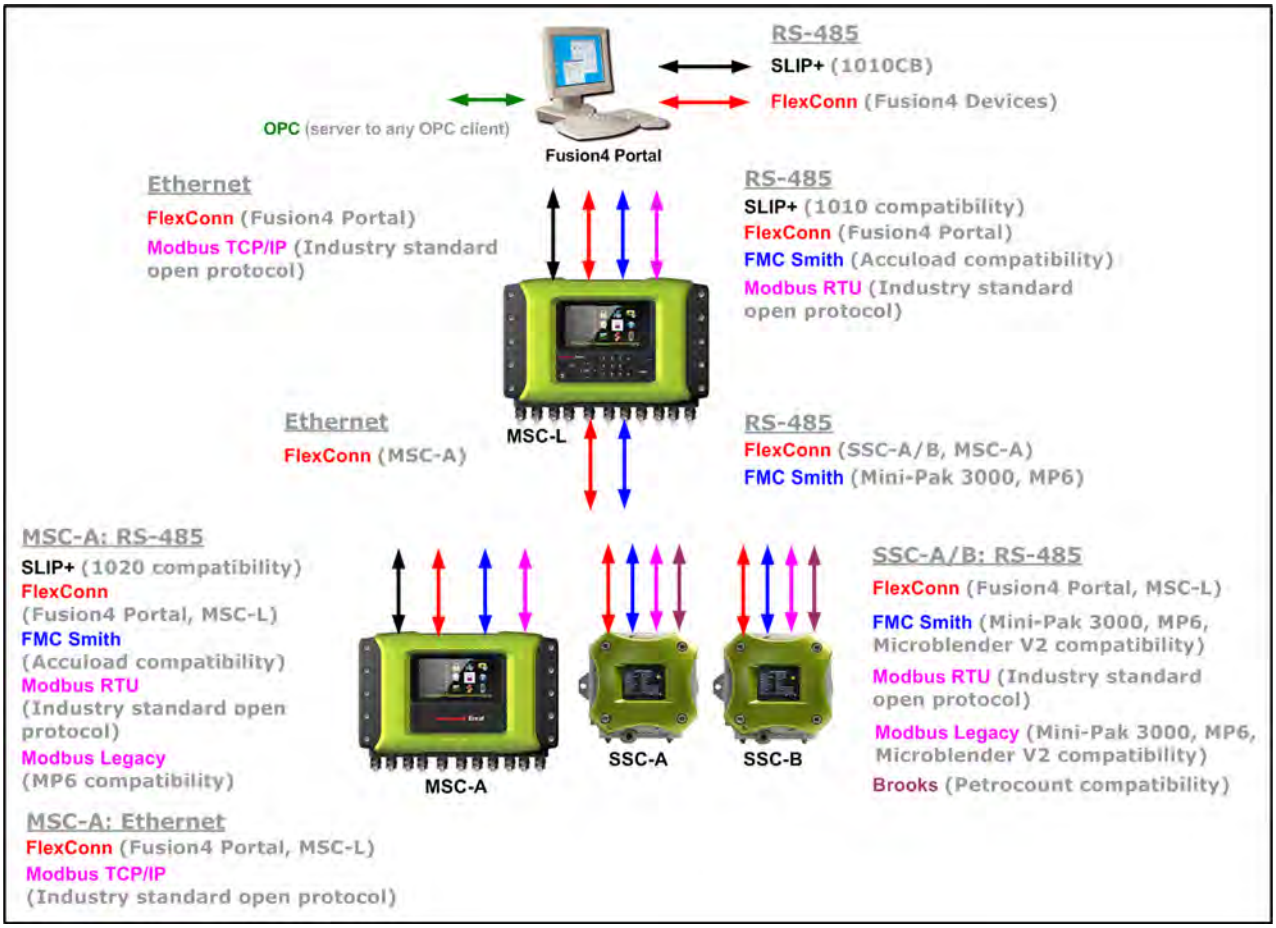

FIGURE 3-1 Fusion4 System Overview

3.1 Fusion4 Portal

3.1.1 Description

Fusion4 Portal is a Windows PC software suite designed to interface with Honeywell Enraf's portfolio of hazardous area control devices. Its main functions are:

- Retrieving data from the connected devices to print a Bill of Lading (BoL) after product has been delivered to a truck or train, etc.
- Configuring, commissioning and diagnosing of controllers
- OPC interfacing
- Monitoring of field devices for the control room
- Printing transactions

Fusion4 Portal can scan and print transaction data of 1 up to 250 streams spread across up to 50 devices, including:

- 1010 CB preset controllers
- Fusion4 SSC-As (Single Stream Controllers for Additive Injection)
- Fusion4 SSC-Bs (Single Stream Controllers for Blending)
- Fusion4 MSC-Ls (Multi-Stream Controllers for Loading) (future implementation)
- Fusion4 MSC-As (Multi-Stream Controllers for Additive Injection)

3.1.2 Principle of Operation

The basic principle of operation is achieved by Fusion4 Portal continuously communicating with the connected devices. As soon as a device has new transaction data available Fusion4 Portal will retrieve this data. When transaction data from a connected device like an SSC-A or MSC-A is received and the print transaction function of the device is enabled, a transaction summary will be printed. When transaction data from a connected device like an SSC-B or 1010CB is received and the print transaction function of the device is enabled, the data, including the applicable engineering units, is immediately printed resulting in a Bill of Lading (BoL). The BoL is printed for custody transfer when a product from storage tanks has been transferred to other parties. Fusion4 Portal certified for printing WM compliant BOLs for Contrec 1010CB and SSC-B. For this reason, Fusion4 Portal is certified for printing W&M compliant BoLs for 1010CB and SSC-B. The transaction data, including the applicable engineering units, is stored immediately after receipt on the hard disk.

Fusion4 Portal features an OPC server that communicates with loading devices like 1010 CB. This server offers OPC connectivity with OPC clients to read, subscribe and write values to the devices to achieve the required workflow at the terminals. An example of an OPC client is a Terminal Automation System (TAS).

3.1.3 Communications

Communication with the devices is realized by using hard-wired, serial EIA RS-422/485 communications ports, which are connected to the devices via serial communication lines.

NOTE: Optionally, the Fusion 4 Portal server may be connected to the devices through a Terminal Server.

Fusion4 Portal includes several different communications protocols. These include:

- FlexConn (see CHAPTER 9)
- SLIP+ (see CHAPTER 8)

NOTE: For more information see:
- Installation & Operation Manual Fusion4 Portal
- Installation & Operation Manual Fusion4 SSC-A
- Installation & Operation Manual Fusion4 SSC-B
- Installation & Operation Manual Fusion4 MSC-A

3.2 Fusion4 SSC-A

3.2.1 General

The Fusion4 SSC-A (Single Stream Controller for Additive Injection) is designed to control one single additive stream. It can operate within any product transfer application, such as road tanker loading, rail off-loading or pipeline transfer, where multiple products need to be accurately combined.

3.2.2 Principle of Operation

The basic principle of operation is achieved by the Fusion4 SSC-A monitoring the flow of the wild stream, and using this flow rate to accurately pace the flow of the additive stream to a pre-determined target ratio in parts per million (ppm).

The pacing of the additive stream is realized through accurate, rapid injections of very small volumes of additive into the process, at frequently and evenly spaced intervals.

The Fusion4 SSC-A is a cycle-based injector, meaning that the additive does not dispense continuously. An internal recipe controls the ratio of additive being injected to the process stream. In a typical application, the process flow rate is monitored by the controller. As chemical additive is called for, the controller opens a solenoid control valve and injects a small quantity of additive into the process stream. When the required quantity is reached, the controller closes the valve and waits until the next injection is required. The injection cycle repeats in this manner, keeping the additive ‘in pace” with the process flow’. The reason for cyclical injection technology is uniform mixing of product and additive.

The injection control of the Fusion4 SSC-A can be achieved in different pacing modes:

- Self-paced mode: The Fusion4 SSC-A autonomously injects on a time and fluid volume basis (configurable).
- Smart mode: An external trigger source (Pulse Input, Digital Input, Analog Input, or Comms) makes the Fusion4 SSC-A inject a configurable additive volume.
- Slave mode: In this case additive injection is fully controlled by an external device.

3.2.3 Communications

Full control of and full access to all setup entities of the Fusion4 SSC-A can be realized by using a hard-wired, serial EIA RS-485 communications port, which is connected to a master system via a data communications line. This master system can be a PC service program, a load computer, a SCADA system, DCS, or any other type of Terminal Automation System.

The Fusion4 SSC-A includes several different communications protocols. These include:

- FlexConn (see CHAPTER 9)
- FMC Smith AccuLoad (see CHAPTER 5)
- Brooks PetroCount (see CHAPTER 6)
- Modbus Legacy and Modbus RTU (see CHAPTER 7)

The Fusion4 SSC-A supports two serial communication ports.

- The CAN-ADD-BLEND board houses a 2- or 4-wire isolated RS-485 communication port.
- The CAN-OPTION-SSC board houses a 2-wire isolated RS-485 communication port.

Alarms are reported through the protocols of the RS-485 communications interface. Alarms may also be cleared using the RS-485 communications interface.

NOTE: For more information see Installation & Operation Manual Fusion4 SSC-A.

3.3 Fusion4 SSC-B

3.3.1 General

The Fusion4 SSC-B (Single Stream Controller for Blending) is a hazardous area, intelligent blend controller, utilizing state-of-the-art microprocessor technology for high-accuracy blending applications.

The MID-compliant Fusion4 SSC-B is designed to control one single blend stream. It can operate within any product transfer application, such as road tanker loading, rail off-loading or pipeline transfer, where multiple products need to be accurately combined.

3.3.2 Principle of Operation

The basic principle of operation is achieved by the Fusion4 SSC-B controller monitoring the flow of the wild stream, and using this flow rate to accurately pace the flow of the blend stream to a predetermined target blend percentage or ratio.

The pacing of the blend stream is achieved through digitally controlled solenoid valves that modulate the position of a variable control valve within the blend stream.

The Fusion4 SSC-B is capable of achieving highly accurate linear control across the complete blend range; allowing for blend ratios from 0% to 100% (practical blend rates are around 5% to 40%) on standard load rack applications.

Temperature and pressure measurements are used to convert the observed blend volume to reference conditions, in order to have very accurate blend transaction data that can be used for W&M-compliant custody transfer.

3.3.3 Communications

Full control of and full access to all setup entities of the Fusion4 SSC-B can be realized by using a hard-wired, serial EIA RS-485 communications port, which is connected to a master system via a data communications line. This master system can be a PC service program, a load computer, a SCADA system, DCS, or any other type of Terminal Automation System.

The Fusion4 SSC-B includes several different communications protocols. These include:

- FlexConn (see CHAPTER 9)
- FMC Smith AccuLoad (see CHAPTER 5)
- Brooks PetroCount (see CHAPTER 6)
- Modbus Legacy and Modbus RTU (see CHAPTER 7)

The Fusion4 SSC-B supports two serial communication ports.

- The CAN-ADD-BLEND board houses a 2- or 4-wire isolated RS-485 communication port.
- The CAN-OPTION-SSC board houses a 2-wire isolated RS-485 communication port.

Alarms are reported through the protocols of the RS-485 communications interface. Alarms may also be cleared using the RS-485 communications interface.

NOTE: For more information see the Installation & Operation Manual Fusion4 SSC-B.

3.4 Fusion4 MSC-A

3.4.1 General

The Fusion4 MSC-A (Multi-Stream Controller for Additive Injection) is designed to control up to twelve additive streams. It can operate within any product transfer application, such as road tanker loading, rail off-loading or pipeline transfer, where multiple products need to be accurately combined.

3.4.2 Principle of Operation

The basic principle of operation is achieved by the Fusion4 MSC-A monitoring the flow of the wild stream, and using this flow rate to accurately pace the flow of the additive stream to a pre-determined target ratio in parts per million (ppm).

The pacing of the additive stream is realized through accurate, rapid injections of very small volumes of additive into the process, at frequently and evenly spaced intervals.

The Fusion4 MSC-A is a cycle-based injector, meaning that the additive does not dispense continuously. An internal recipe controls the ratio of additive being injected to the process stream. In a typical application, the process flow rate is monitored by the controller. As chemical additive is called for, the controller opens a solenoid control valve and injects a small quantity of additive into the process stream. When the required quantity is reached, the controller closes the valve and waits until the next injection is required. The injection cycle repeats in this manner, keeping the additive ‘in pace’ with the process flow. The reason for cyclical injection technology is uniform mixing of product and additive.

The injection control of the Fusion4 MSC-A can be achieved in different pacing modes:

- Self-paced mode: The Fusion4 MSC-A autonomously injects on a time and fluid volume basis (configurable).
- Smart mode: An external trigger source (Pulse Input, Digital Input, Analog Input, or Comms) makes the Fusion4 MSC-A inject a configurable additive volume.
- Slave mode: In this case additive injection is fully controlled by an external device.

3.4.3 Communications

Full control of and full access to all setup entities of the Fusion4 MSC-A can be realized by using:

- A hard-wired, serial EIA RS-485 communications port, which is connected to a master system via a data communications line
- Ethernet

This master system can be a PC service program, a load computer, a SCADA system, DCS, or any other type of Terminal Automation System.

The Fusion4 MSC-A includes several different communications protocols. These include:

<u>RS-485</u>

- FlexConn (see CHAPTER 9)
- FMC Smith AccuLoad (see CHAPTER 5)
- Modbus Legacy and Modbus RTU | TCP/IP (see CHAPTER 7)

<u>Ethernet</u>

- Flex Conn (see CHAPTER 9)
- Modbus TCP/IP (see CHAPTER 13)

The Fusion4 MSC-A supports the following serial communication ports.

- The CAN-ARM-MSC-1 board houses one isolated terminal connector with two 2-wire half-duplex RS-485 communication ports.
- The CAN-ARM-MSC-2 board houses one isolated terminal connector with two 2-wire half-duplex RS-485 communication ports.
- The CAN-HMI-MSC board houses one isolated terminal connector with two 2-wire half-duplex RS-485 communication ports and one 4-wire full-duplex RS-485 terminal connector.

Alarms are reported through the protocols of the RS-485 communications interface. Alarms may also be cleared using the RS-485 communications interface.

NOTE: For more information see the Installation & Operation Manual Fusion4 MSC-A.

3.5 Fusion4 MSC-L

=> Future implementation

CHAPTER 4 RS-485 COMMUNICATIONS

The Fusion4 controllers (Fusion4 SSC-A, Fusion4 SSC-B, Fusion4 MSC-A and in the future Fusion4 MSC-L) use the EIA-485 standard for communications. A converter is required to enable communications with peripheral devices such as modems or personal computers that use the EIA-232 interface standard.

Proper system wiring is critical to the reliable operation of serial communication interfaces. Improper wiring can cause high data-error rates and reduce data throughput. Although exact wiring requirements vary depending on the type of interface used, each of the following is important to the overall success of a communications system:

- Cable lengths and types
- Shielding
- Twisted Pair Wiring

RS-485 interfaces are typically used in multi-drop configurations. When installing a 2-wire cable for use with a Fusion4 controller, receive and transmit share the same conductor pair (half-duplex). The wires must be a twisted pair. Wiring for RS-485 must be designed as a Daisy chain. Cable stubs are permitted so long as they are 4.5 m (15 feet) or less in length. Conductor pairs must be terminated with a termination resistor at the most distant end, to ensure proper line impedance for maximum signal reception. Without termination resistors, reflections of fast driver edges can cause multiple data edges that can cause data corruption. Termination resistors also reduce electrical noise sensitivity due to the lower impedance. The value of each termination resistor should be equal to the cable characteristic impedance (typically, 120 ohms for twisted pairs).

Using the recommended cable (Belden Cable 9841 for 2-wire), an RS-485 interface may support maximum 32 slave devices onto one master (host) over a maximum wire length of 1000 m (3281 feet). The host (master) initiates the communication by addressing one of the slaves in its query. Only the addressed slave will respond.

4.1 Characteristics

TABLE 4-1 displays the characteristics of an RS-485 interface used for communications.

TABLE 4-1 Characteristics of RS-485 Interface

Item	Min.	Typical	Max.	Unit
Terminator resistor R_T	118	120	122	Ω
Driver common mode voltage	-1	-	+3	V
Driver output voltage, Open circuit	1.5 -1.5	-	6 -6	V
Driver output voltage, Loaded	1.5 -1.5	-	5 -5	V
Driver output short circuit current	-	-	±250	mV
Receiver common mode voltage	-7	-	+12	V
Receiver sensitivity	-	-	±200	mV
Receiver input resistance	12	-	-	kΩ
Data transmission rate	-	-	500	kbps
Number of connected devices	-	-	32	-

4.2 Cable Specifications

TABLE 4-2 displays the specifications of a cable used in RS-485 interfaces.

TABLE 4-2 Cable Specifications for RS-485 Interfaces

Item	Min.	Typ.	Max.	Unit
Cable length	-	-	1000 [3281]	m [ft]
Cable characteristic impedance	-	120		Ω
Cable DC resistance	-	-	100	Ω
Cable capacitance	-	-	55.77 [17]	pF/m [pF/ft]

CHAPTER 5 FMC SMITH ACCULOAD PROTOCOL

5.1 Description

The FMC Smith AccuLoad protocol is closely related to the protocol defined by Smith Meter Inc. for use with their AccuLoad® Electronic Preset. In the FMC Smith AccuLoad protocol, there are two different message formats, depending on whether the message originated from the master or from a controller.

- The format for a command message from the master to a controller is:

STX	$A_1A_2A_3$	text	ETX	LRC

Term	Description	Hex value
STX	Start of Text Character	0x02
$A_1A_2A_3$	3-digit address of the Fusion4 controller	
text	ASCII string containing the command instruction	
ETX	End of Text Character	0x03
LRC	Longitudinal Pad Redundancy Check	

- The format for a response message from a controller to the master is:

NUL	STX	$A_1A_2A_3$	text	ETX	LRC	PAD

Term	Description	Hex value
NUL	Null Character	0x00
STX	Start of Text Character	0x02
$A_1A_2A_3$	3-digit address of the Fusion4 controller	
text	ASCII string containing the acknowledgment	
ETX	End of Text Character	0x03
LRC	Longitudinal Redundancy Check	
PAD	Pad Character	0x7F

The longest packet string transmitted or received by the controller can be no longer than 255 characters in length. The command to or the response from the controller is contained in the text field. The format for this field is defined in the descriptions of the allowed commands and responses below.

5.1.1 Text Field Format

The structure of the text field is very specific for each command. The formats for the text field apply whether the string is a request from the master or a response from the controller. The format of the data associated with a given parameter code is specific and cannot be varied. Only one command may be transmitted to the controller in a given text field.

The Parameter and Task Code formats are described in detail in the specific Fusion4 controller Installation & Operation Manuals. All leading and trailing zeros on numbers must be transmitted. Even though the alphanumeric data strings are of variable length, they cannot be longer than the maximum length specified. The controller determines the end of the string when either a semi-colon or an ETX is encountered.

When a protocol string is received by the controller, it is first checked for transmission errors by using the LRC. The LRC is a 7-bit exclusive-OR of the characters in the protocol string following the STX character up to and including the ETX character. If the LRC of the received string does not match the received LRC value, an error has occurred in transmission and the Fusion4 controller will ignore the string.

5.1.2 Broadcast Commands

A Fusion4 controller is capable of receiving a ‘broadcast’ command from the master unit using the FMC Smith AccuLoad protocol. A broadcast command is one that is directed to all the controllers on the communications bus, simultaneously. In the controller, the addresses 998, 999, and 000 are reserved for use as the Broadcast Address. Any command message that is addressed to a controller‘s Broadcast Address, is recognized by that unit and processed. However, unlike a command to a controller’s primary address, a broadcast command generates no response from the controller. Clearing alarms and setting the time/date are examples of the use of broadcast commands. Only write commands or task commands may be broadcast since a read command by definition requires a response and responses to broadcast commands are not allowed.

5.1.3 Command Identifier Prefixes

In TABLE 5-1 the command identifier prefixes that are available in the FMC Smith AccuLoad protocol are listed.

TABLE 5-1 FMC Smith AccuLoad Protocol: Command Identifier Prefixes

Identifier	Description
RV	Read a value from the Fusion4 controller
WV	Write a value to the Fusion4 controller
EX	Execute a task function in the Fusion4 controller

5.1.3.1 RV - Read Value

This command instructs the controller to read a memory location.

- Request

‘RV_XXX’	
XXX	Parameter register code
_	Denotes a space

- Response

‘RV_XXX_A_0....A_n’	Command completed successfully
XXX	Parameter register code
A_0....A_n	Value of the parameter register requested. It is an ASCII character string whose format is defined in the specific controller manual.
_	Denotes a space
‘NOXX’	**Execution of the command failed**
XX	Two digit error code as defined in section 5.1.4.

5.1.3.2 WV - Write Value

This command instructs the controller to program a memory location.

- Request

‘WV_XXX_A_0....A_n’	
XXX	Parameter register code to be written to
A_0....A_n	Data to be written to the parameter register XXX. The data string must conform exactly to the format for that code as defined in the specific controller manual.
_	Denotes a space

- Response

'OK'	Value was programmed successfully
'NOXX'	**Execution of the command failed**
XX	Two digit error code as defined in section 5.1.4.

5.1.3.3 EX - Execute Task

This command instructs the controller to execute a task function.

- Request

'EX_XXX'	
XXX	Task code as defined in the specific controller manual
_	Denotes a space

- Response

'OK'	Task was completed successfully
'NOXX'	**Execution of the command failed**
XX	Two digit error code as defined in section 5.1.4.

5.1.4 Error Codes

The controller is capable of returning several error messages to the master unit if it is unable to successfully carry out a command. These error messages are in the form of 'NOXX' where ' XX' is a two-character number representing the error that occurred.

The individual errors that the controller is capable of responding to are listed in TABLE 5-2.

TABLE 5-2 FMC Smith AccuLoad Protocol: Error Codes

Error No.	Description	Explanation
00	Illegal Command	Command code is not recognized.
01	Transaction in Progress	Controller is permitted. No measurement parameters can be changed.
02	Illegal Value	Value is out of range
03	Syntax Error in Value	Value string is not in the correct format.
04	Illegal Text String Format	Construction of the text field is incorrect.
05	Unit in Critical Alarm	Alarm must be cleared before the command can be completed.

Error No.	Description	Explanation
06	Option Not Installed	Command code is not supported in this version of the controller.
07	No Transaction in Progress	Transaction must be in progress to execute the command code.
08	Transmission Error (LRC failed)	Error occurred in the protocol string during transmission.
09	In Local Programming Mode	Controller is being programmed with the hand held controller.
10	Commands out of Sequence	Another command code must be performed before the current one can be.
11	Write Attempt to a Read Only Value	Tried to store a value to a read only parameter register.
12	Access Denied to Security Code	Future Use
13	No Records Found	This error results when trying to read or clear records from the Transaction or Security Log and no records are present.

5.1.5 Examples

Example 1. The master requests the Active Alarm Status (802) of controller with address 123. The controller has no active alarms.

- Request

STX	123	RV 802	ETX	LRC

- Response

NUL	STX	123	RV 802 0000	ETX	LRC	PAD

Example 2. The master sets the Additive K-Factor to 6300.000 on controller with address 313.

- Request

STX	313	WV 001 6300.000	ETX	LRC

- Response

NUL	STX	313	OK	ETX	LRC	PAD

Example 3. The master sets the time on all the controllers on the communication loop at the same time (broadcast command). The time is 02:34:13 PM. Number 999 is the broadcast address for the system.

- Request

STX	999	WV 111 14:34:13	ETX	LRC

- Response

None.

5.2 Fusion4 SSC-A

TABLE 5-3 lists the FMC Smith AccuLoad protocol parameters for the Fusion4 SSC-A (Single Stream Controller for Additive Injection). See section 15.1 for a description of the parameters.

TABLE 5-3 FMC Smith AccuLoad Protocol Parameters for Fusion4 SSC-A

Parameter Name	Param. Number	Parameter Format	Access	Format	Min.	Max.	Default
Wild stream K-factor	001	floating point	R	nnnnn.nnn			
Additive K-factor	002	floating point	R	nnnnn.nnn			
Injection volume	010	floating point	R/W	nnnn.n			
Volume per injection cycle	020	floating point	R/W	nnnn.n			
Solenoid dwell time	030	integer	R	nnnnn			
Minimum product volume for transaction	040	floating point	R/W	nnn			
Factored pulse output resolution	050	enumeration (see section 15.2.1.5)	R	n	2	5	
Number of clean start cycles	060	integer	R/W	nn			
Flush volume	061	floating point	R/W	nnn			
High flow threshold value	063	floating point	R/W	nnnnn			
Low flow threshold value	064	floating point	R/W	nnnnn			
Transaction closing time	065	integer	R/W	nnn			
Pacing source	080	enumeration (see section 15.2.1.4)	R	n	0	2	
Permissive function	081	enumeration (see section 15.2.1.6)	R/W	n	0	2	

Parameter Name	Param. Number	Parameter Format	Access	Format	Min.	Max.	Default
Injection offset	090	integer	R/W	nnn			
Unit address	100	integer	R	nnn			
Broadcast address	101	integer	R	nnn			
Number of solenoid retries	131	integer	R	n			
DI hysteresis time	132	integer	R	nnnn			
Feedback pulse duration	133	integer	R	nnnn			
Pump run timeout	134	integer	R/W	nnn			
No additive alarm action	310	enumeration (see section 15.2.1.2)	R	n	0	2	
No additive timeout period	311	integer	R	n			
Additive volume deviation alarm action	320	enumeration (see section 15.2.1.2)	R	n	0	2	
Additive volume deviation allowed	322	integer	R/W	nnn			
Additive deviation basis	323	integer	R	nn	5	20	
Leaking solenoid alarm action	340	enumeration (see section 15.2.1.2)	R	n	0	2	
Leaking solenoid volume limit	341	floating point	R	nnn			
Leaking solenoid timeout period	342	integer	R	nn			
No activity timeout alarm action	370	enumeration (see section 15.2.1.2)	R	n	0	2	
No activity timeout period	371	integer	R	nnn			
Active alarms	802	bitmask (see section 15.2.1.8)	R	hhhh			
Permissive state	804	enumeration (see section 15.2.1.3)	R	n	0	1	
Solenoid close delay	805	integer	R	nnnn			
Additive stream flow rate	809	floating point	R	nnnnn			

Parameter Name	Param. Number	Parameter Format	Access	Format	Min.	Max.	Default
Accumulative wild stream gross observed volume	810	floating point	R	nnnnnnn			
Accumulative total additive stream gross observed volume	850	floating point	R	nnnnnnn			
Accumulative transactional additive stream gross observed volume	860	floating point	R	nnnnnnn			
Accumulative leaking solenoid gross observed volume	870	floating point	R	nnnnnnn			
Accumulative calibration gross observed volume	880	floating point	R	nnnnnnn			
Load stream flow rate	881	floating point	R	nnnnn.nnn			
Additive stream flow rate	882	floating point	R	nnnnn.nnn			
Transaction PPM	883	floating point	R	nnnnn			
Task register	888	integer (see section 15.2.1.1)	W	hhhh			
Firmware version number	890	string	R	aaaaaa			
Product ID	892	string	R	aaaaaaaaa			
Device serial number	893	string	R	ssssssss			

5.3 Fusion4 SSC-B

TABLE 5-4 lists the FMC Smith AccuLoad protocol parameters for the Fusion4 SSC-B (Single Stream Controller for Blending). See section 15.1 for a description of the parameters.

TABLE 5-4 FMC Smith AccuLoad Protocol Parameters for Fusion4 SSC-B

Parameter Name	Param. Number	Parameter Format	Access	Format	Min.	Max.	Default
Wild stream K-factor	001	floating point	R	nnnnn.nnn			100
Blend stream K-factor	002	floating point	R	nnnnn.nnn			750

Parameter Name	Param. Number	Parameter Format	Access	Format	Min.	Max.	Default
Target blend percentage rate A	010	floating point	R/W	nnn.nn			0
Target blend percentage rate B	011	floating point	R/W	nnn.nn			0
Target blend percentage rate C	012	floating point	R/W	nnn.nn			0
Target blend percentage rate D	013	floating point	R/W	nnn.nn			0
Target blend percentage rate E	014	floating point	R/W	nnn.nn			0
Dead band control window limit	020	floating point	R/W	nnnn.nn	0.01	10000	0.1
Inner control window limit	021	floating point	R	nnnn.nn	0.01	10000	1
Middle control window limit	022	floating point	R	nnnn.nn	0.01	10000	10
Outer control window limit	023	floating point	R	nnnn.nn	0.01	10000	100
Solenoid active dwell	030	integer	R	nnnn	50	1000	100
Solenoid rest dwell	031	integer	R	nnnn	50	1000	100
Permissive function	040	enumeration (see section 15.2.2.10)	R	n	0	1	1
Blend stream pulse timeout	041	integer	R	nn	1	90	2
Wild stream pulse timeout	042	integer	R	nnn	1	999	5
Deviation count smoothing value	044	integer	R	nn	0	12	10
Reset blend deviation counter at transaction start	045	enumeration (see section 15.2.2.6)	R	n	0	1	0
Multifunction DC output #1	049	enumeration (see section 15.2.2.5)	R	n	2	5	2
Multi function DC output #2	050	enumeration (see section 15.2.2.5)	R	n	2	5	2
Preset gross observed volume	060	floating point	R/W	nnnnnn	0	999999	0
Flush volume	061	floating point	R/W	nnn	0	999	0
Pre-shutdown control	062	enumeration	R	n	0	2	0
Pre-shutdown volume	063	floating point	R/W	nnnn	0	9999	0

Parameter Name	Param. Number	Parameter Format	Access	Format	Min.	Max.	Default
Clean start control	070	enumeration (see section 15.2.2.8)	R	n	0	1	0
Blend point relative to wild stream meter	080	enumeration (see section 15.2.2.3)	R	n	0	1	0
Gross standard volume calculation interval	082	floating point	R	nnnn.nn			
Temperature compensation used	083	boolean	R	n			
Unit address	100	integer	R	nnn			
Broadcast address	101	integer	R	nnn			
DI hysteresis time	132	integer	R	nnnn			
Calibration high flow rate	200	floating point	R	nnnn	1	9999	60
Calibration low flow rate	201	floating point	R	nnn	1	100	15
Calibration inner control window limit	210	integer	R	nnn	1	100	10
Calibration outer flow rate control window	211	integer	R	nnnn	1	9999	25
Calibration start low flow volume	220	floating point	R	nnnn	1	9999	25
Calibration end low flow volume	221	floating point	R	nnnn	1	9999	25
Calibration final shut down volume	230	floating point	R	nnn	0	999	20
Flow calculation smoothing value	240	integer	R	nn	1	99	10
Control failure alarm action	310	enumeration (see section 15.2.2.2)	R	n	0	2	2
Control failure alarm timeout	311	integer	R	nn	1	30	10
Blend percentage deviation alarm action	320	enumeration (see section 15.2.2.2)	R	n	0	2	2
Blend low percentage allowed	321	integer	R/W	nn	1	99	95
Blend high percentage allowed	322	integer	R/W	nnn	101	999	105
Minimum wild stream volume for alarm	323	floating point	R/W	nnn	1	999	5

Parameter Name	Param. Number	Parameter Format	Access	Format	Min.	Max.	Default
Leaking blend valve alarm action	340	enumeration (see section 15.2.2.2)	R	n	0	2	2
Leaking blend valve volume limit	341	floating point	R	nnnn	1	9999	100
Wild stream closing volume alarm action	350	enumeration (see section 15.2.2.2)	R	n	0	2	2
Wild stream closing volume	351	floating point	R	nnnn	1	9999	150
Blend stream closing timeout alarm action	360	enumeration (see section 15.2.2.2)	R	n	0	2	2
Blend stream closing timeout	361	integer	R	nnn	1	240	60
No activity alarm action	370	enumeration (see section 15.2.2.2)	R	n	0	2	2
No activity timeout	371	integer	R	nn	1	65535	30
Flush volume alarm action	380	enumeration (see section 15.2.2.2)	R	n	0	2	2
Flush volume deviation	381	integer	R/W	nnn	1	100	25
Active alarms	802	integer (see section 15.2.2.18)	R	hhhh	0	65535	0
Permissive state	804	enumeration (see section 15.2.2.4)	R	n	0	1	0
Accumulative wild stream gross observed volume	810	floating point	R	nnnnnnnn	0	99999999	0
Accumulative blend stream gross observed volume	820	floating point	R	nnnnnnnn	0	99999999	0
Accumulative blend stream gross standard volume	825	floating point	R	nnnnnnnn	0	99999999	0
Transactional wild stream gross observed volume	830	floating point	R	nnnnnn.nn	0	999999.99	0
Transactional blend stream gross observed volume	840	floating point	R	nnnnnn.nn	0	999999.99	0

Parameter Name	Param. Number	Parameter Format	Access	Format	Min.	Max.	Default
Transactional blend stream gross standard volume	845	floating point	R	nnnnnn.nn	0	999999.99	0
Transactional blend percentage (normal mode)	850	floating point	R	nnn.nn	0	100.00	0
Accumulative blend volume (emulation mode only)	850	floating point	R	nnnnnnnn	0		0
Transaction deviation count	860	floating point	R	nnnnn			0
Transaction current average temperature	865	floating point	R	nnn.n	-999.9	999.9	0
Instantaneous temperature	866	floating point	R	nnn.n	-999.9	999.9	0
Accumulative leaking blend stream gross observed volume	870	floating point	R	nnnnnnnn	0	99999999	0
Accumulative calibration gross observed volume	880	floating point	R	nnnnnnnn	0	99999999	0
Wild stream flow rate	881	floating point	R	nnnn			
Blend stream flow rate	882	floating point	R	nnnn			
Transactional blend percentage	883	floating point	R	nnnn			
Task register	888	enumeration (see section 15.2.2.1)	W		1	802	
Firmware version number	890	string	R	aaaaaa			
Product ID	892	string	R	aaaaaaaaa			
Device serial number	893	string	R	aaaaaaaa			

5.4 Fusion4 MSC-A

TABLE 5-5 lists the FMC Smith AccuLoad protocol parameters for the Fusion4 MSC-A (Multi-Stream Controller for Additive Injection). See section 15.1 for a description of the parameters.

TABLE 5-5 FMC Smith AccuLoad Protocol Parameters for Fusion4 MSC-A

Parameter Name	Param. Number	Parameter Format	Access	Format	Min.	Max.	Default
Wild stream K-factor	001	floating point	R	nnnnn.nnn			
Additive K-factor	002	floating point	R	nnnnn.nnn			
Injection volume	010	floating point	R/W	nnnn.n			
Volume per injection cycle	020	floating point	R/W	nnnn.n			
Solenoid dwell time	030	integer	R	nnnnn			
Minimum product volume for transaction	040	floating point	R/W	nnn			
Factored pulse output resolution	050	enumeration (see section 15.2.1.5)	R	n	2	5	
Number of clean start cycles	060	integer	R/W	nn			
Flush volume	061	floating point	R/W	nnn			
High flow threshold value	063	floating point	R/W	nnnnn			
Low flow threshold value	064	floating point	R/W	nnnnn			
Transaction closing time	065	integer	R/W	nnn			
Pacing source	080	enumeration (see section 15.2.1.4)	R	n	0	2	
Permissive function	081	enumeration (see section 15.2.1.6)	R/W	n	0	2	
Injection offset	090	integer	R/W	nnn			
Unit address	100	integer	R	nnn			
Number of solenoid retries	131	integer	R	n			
Feedback pulse duration	133	integer	R	nnnn			

Parameter Name	Param. Number	Parameter Format	Access	Format	Min.	Max.	Default
Pump run timeout	134	integer	R/W	nnnn			
No additive alarm action	310	enumeration (see section 15.2.1.2)	R	n	0	2	
No additive flow time-out period	311	integer	R	n			
Additive volume deviation alarm action	320	enumeration (see section 15.2.1.2)	R	n	0	2	
Additive volume deviation allowed	322	integer	R/W	nnn			
Additive deviation basis	323	integer	R	nn			
Leaking solenoid alarm action	340	enumeration (see section 15.2.1.2)	R	n	0	2	
Leaking solenoid vol-ume limit	341	floating point	R	nnn			
Leaking solenoid time-out period	342	integer	R	nn			
No activity timeout alarm action	370	enumeration (see section 15.2.1.2)	R	n	0	2	
No activity timeout period	371	integer	R	nnn			
Slow flow volume alarm action	380	enumeration (see section 15.2.1.2)	R	n			
Active alarms	802		R	hhh			
Permissive state	804	enumeration (see section 15.2.1.3)	R	n	0	1	
Solenoid close delay	805	integer	R	nnnn			
Alarm and permissive state (injectors 1 - 6)*	806		R				
Alarm and permissive state (injectors 7 - 12)*	807		R				
Additive stream flow rate	809	floating point	R	nnnnn			
Accumulative wild stream gross observed volume	810	floating point	R	nnnnnnn			
Accumulative total additive stream gross observed volume	850	floating point	R	nnnnnnn			

Parameter Name	Param. Number	Parameter Format	Access	Format	Min.	Max.	Default
Accumulative transactional additive stream gross observed volume	860	floating point	R	nnnnnnn			
Accumulative leaking solenoid gross observed volume	870	floating point	R	nnnnnnn			
Accumulative calibration gross observed volume	880	floating point	R	nnnnnnn			
Load stream flow rate	881	floating point	R	nnnnn.nnn			
Additive stream flow rate	882	floating point	R	nnnnn.nnn			
Transaction PPM	883	floating point	R	nnnnn			
Task register	888	integer (see section 15.2.1.1)	W	hhhh			
Software version*****	890	string	R	aaaaaa			
Product ID*****	892	string	R	aaaaaaaaa			
Device serial number*****	893	string	R	aaaaaaaa			

REMARK: The ***** (asterisk) denotes global parameters affecting ALL injector channels.

5.5 Fusion4 MSC-L

=> Future implementation

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CHAPTER 6 BROOKS PETROCOUNT PROTOCOL

6.1 Description

The Brooks Petrocount Protocol is provided to allow users with Brooks Instrument's PetroCount® IMS Presets to easily communicate with the Fusion4 controller.

Existing software communications drivers used to communicate with the Brooks units can be used to communicate with the Fusion4 controller. All that needs to be taken into account is the parameter code table for the controller.

In the Brooks PetroCount protocol, the message format is the same, regardless of whether the transmission originated from the master or from the controller.

- The format for a command message in the Brooks PetroCount protocol is:

SOH	$D_1D_2D_3$	$S_1S_2S_3$	STX	text	ETX	BCC1	BCC2

Term	Description	Hex value
SOH	Start of Header	0x01
$D_1D_2D_3$	3-digit address of the Destination controller	
$S_1S_2S_3$	3-digit address of the Source controller	
STX	Start of Text Character	0x02
text	ASCII string containing the instruction / response	
ETX	End of Text Character	0x03
BCC1	MSB of the Binary Checksum of the string	
BCC2	LSB of the Binary Checksum of the string	

The longest packet string transmitted or received by the controller can be no longer than 255 characters in length. The command to or the response from the controller is contained in the text field. The format for this field is defined in the descriptions of the allowed commands and responses below.

6.1.1 Text Field Format

The structure of the text field is very specific. This applies to the field whether the string is a request from the master or a response from the controller. The format of the data associated with a given parameter code is also specific and cannot be varied. The Parameter and Task Codes are described in detail in the specific controller manuals.

The data contained in the text field has a specific format depending on which parameter code it is associated with. All data within the text field must be formatted exactly as described in the controller manual. All leading and trailing zeros on numbers must be transmitted. Even though the alphanumeric data strings are variable length, they cannot be longer than the maximum length specified. The controller determines the end of the string when a semi-colon or an ETX is encountered.

When a protocol string is received by the controller, it is first checked for transmission errors by using the Binary Check Characters (BCC). The BCC is an 8-bit binary sum of the characters in the protocol string from the SOH character to the ETX character, inclusive. BCC1 and BCC2 are the ASCII hexadecimal representation of the BCC, with BCC1 being the most significant four bits. If the BCC of the received string does not match the received BCC, an error has occurred in transmission and the controller will ignore the string.

6.1.2 Broadcast Commands

The Fusion4 controller is capable of receiving a ‘broadcast’ command from the master unit using the Brooks PetroCount protocol. A broadcast command is a command that is directed to all the controllers on the communications bus simultaneously. In the controller, the addresses 998, 999, and 000 are reserved for use as the Broadcast Address. Any command message that is addressed to a controller‘s Broadcast Address, is recognized by that controller and processed.

However, unlike a command to a controller’s primary address, there is no response from the controller to a broadcast command. Clearing alarms and setting the time/date are examples of the use of broadcast commands. Only write commands or task commands may be broadcast since a read command by definition requires a response and responses to broadcast commands are not allowed.

6.1.3 Command Identifier Prefixes

TABLE 6-1 lists the command identifier prefixes that are available in the FMC Smith AccuLoad protocol.

TABLE 6-1 Brooks Petrocount Protocol: Command Identifier Prefixes

Identifier	Description
R	Read a data register in the controller
W	Write to a data register with data return
A	Write to a data register with return acknowledge
B	Write to a data register with no response
X	Execute a task in the controller

6.1.3.1 R - Read Value

This command instructs the controller to transmit the contents of a register back to the master.

- Request

'RPPP'	
PPP	Parameter register code defined in the specific controller manual

- Response

'PPP=A_0....A_n'	**Command completed successfully**
PPP	Parameter register code
A_0....A_n	Value of the parameter register requested. It is an ASCII character string whose format is defined in the specific controller manual.
'NAK'	**Response failed; NAK control character (15 hex)**

6.1.3.2 W - Write a Value with Return Data Acknowledge

This command instructs the controller to program a parameter register and acknowledge the command with return data.

- Request

'WPPP=A_0....A_n'	
PPP	Parameter register code defined in the specific controller manual
A_0....A_n	Value of the parameter register requested. It is an ASCII character string whose format is defined in the specific controller manual.

- Response

'WPPP=A_0....A_n'	**Command completed successfully**
PPP	parameter register code
A_0....A_n	Value of the parameter register requested. It is an ASCII character string whose format is defined in the specific controller manual.
'NAK'	**Response failed; NAK control character (15 hex)**

6.1.3.3 A - Write a Value with ACK Acknowledge

This command instructs the Fusion4 controller to program a parameter register and acknowledge the command with an ACK control character.

- Request

'APPP=A_0....A_n'	
PPP	Parameter register code as defined in the specific Fusion4 controller manual
A_0....A_n	Value of the parameter register requested. It is an ASCII character string whose format is defined in the specific Fusion4 controller manual.

- Response

'ACK'	**Successful; ACK control character (06 hex)**
'NAK'	**Response failed; NAK control character (15 hex)**

6.1.3.4 B - Write a Value with No Response

This command instructs the Fusion4 controller to program a parameter register and to not respond. Only command type that can be used with the Broadcast Command.

- Request

'BPPP=A_0....A_n'	
PPP	Parameter register code as defined in the specific Fusion4 controller manual
A_0....A_n	Value of the parameter register requested. It is an ASCII character string whose format is defined in the specific Fusion4 controller manual.

- Response

None	

6.1.3.5 X - Execute a Task in the Fusion4 Controller

This command instructs the Fusion4 controller to execute a task.

- Request

'XPPP'	
PPP	number of the task to execute as defined in the specific Fusion4 controller manual

- Response

'XPPP=Y'	**Successful**
PPP	Number of the task that was executed
'NAK'	**Response failed; NAK control character (15 hex)**

6.1.4 Error Messages

When an error is detected in the text field by the Fusion4 controller, it will respond with a NAK character. Reasons that can cause a command to fail and a NAK to be sent back to the master are listed in TABLE 6-2.

The master has no way of knowing which condition caused the error. However, once the master's software is installed and debugged, most of these conditions will not present a problem.

TABLE 6-2 Brooks Petrocount Protocol: Error Messages

Error message	Explanation
Illegal Command	Command code is not recognized.
Illegal Value	Value is out of range.
Syntax Error In Value	Value string is not in the correct format.
Illegal Text String Format	Construction of the text field is incorrect.
Unit In Critical Alarm	Alarm must be cleared before the command can be completed.
Option Not Installed	Command code is not supported in this version of the controller
Transaction In Progress	Controller is permitted. Certain parameters can not be changed.
No Transaction in Progress	Transaction must be in progress to execute the code.
Transmission Error (BCC failed)	Error occurred in the protocol string during transmission.
In Local Programming Mode	Controller is being programmed with the hand-held controller.
Commands Out Of Sequence	Another command code must execute before the current one can.
Write Attempt to a Read Only Value	Tried to store a value to a read only parameter register.

6.1.5 Examples

Example 1. The master requests the Active Alarm Status (802) of controller with address 123. The controller has no active alarms. The master's address is 689.

- Request

SOH	123	689	STX	R802	ETX	BCC1	BCC2

- Response

SOH	689	123	STX	802=0000	ETX	BCC1	BCC2

Example 2. The master sets the Additive K-Factor to 6300.000 on controller with address 313. It wants a data response from the controller.

- Request

SOH	313	689	STX	W001=6300.000	ETX	BCC1	BCC2

- Response

SOH	689	313	STX	W001=6300.000	ETX	BCC1	BCC2

Example 3. The master sets the User #3 Password to 5434 in the controller with address 246. It wants an acknowledge response from the controller.

- Request

SOH	246	689	STX	A720=5434	ETX	BCC1	BCC2

- Response

SOH	689	246	STX	ACK	ETX	BCC1	BCC2

Example 4. The master sets the time on all controllers on the communication loop at the same time (broadcast command). The time is 02:34:13 PM. Number 999 is the broadcast address for the system.

- Request

SOH	999	689	STX	B111=14:34:13	ETX	BCC1	BCC2

- Response
  None.

Example 5. The master sets the factored pulse output resolution (050) to 1/100th of a unit volume. The controller's address is 423, and the master wants a response with data.

- Request

SOH	423	689	STX	W050=2	ETX	BCC1	BCC2

- Response

SOH	689	423	STX	W050=2	ETX	BCC1	BCC2

6.2 Fusion4 SSC-A

TABLE 6-3 lists the Brooks Petrocount protocol parameters for the Fusion4 SSC-A (Single Stream Controller for Additive Injection). See section 15.1 for a description of the parameters.

TABLE 6-3 Brooks PetroCount Protocol Parameters for Fusion4 SSC-A

Parameter Name	Param. Number	Parameter Format	Access	Format	Min.	Max.	Default
Wild stream K-factor	001	floating point	R	nnnnn.nnn			
Additive K-factor	002	floating point	R	nnnnn.nnn			
Injection volume	010	floating point	R/W	nnnn.n			
Volume per injection cycle	020	floating point	R/W	nnnn.n			
Solenoid dwell time	030	integer	R	nnnnn			
Minimum product volume for transaction	040	floating point	R/W	nnn			
Factored pulse output resolution	050	enumeration (see section 15.2.1.5)	R	n	2	5	
Number of clean start cycles	060	integer	R/W	nn			
Flush volume	061	floating point	R/W	nnn			
High flow threshold value	063	floating point	R/W	nnnnn			
Low flow threshold value	064	floating point	R/W	nnnnn			
Transaction closing time	065	integer	R/W	nnn			
Pacing source	080	enumeration (see section 15.2.1.4)	R	n	0	2	
Permissive function	081	enumeration (see section 15.2.1.6)	R/W	n	0	2	
Injection offset	090	integer	R/W	nnn			
Unit address	100	integer	R	nnn			
Broadcast address	101	integer	R	nnn			
Number of solenoid retries	131	integer	R	n			

Parameter Name	Param. Number	Parameter Format	Access	Format	Min.	Max.	Default
DI hysteresis time	132	integer	R	nnnn			
Feedback pulse duration	133	integer	R	nnnn			
Pump run timeout	134	integer	R/W	nnn			
No additive alarm action	310	enumeration (see section 15.2.1.2)	R	n	0	2	
No additive timeout period	311	integer	R	n			
Additive volume deviation alarm action	320	enumeration (see section 15.2.1.2)	R	n	0	2	
Additive volume deviation allowed	322	integer	R/W	nnn			
Additive deviation basis	323	integer	R	nn	5	20	
Leaking solenoid alarm action	340	enumeration (see section 15.2.1.2)	R	n	0	2	
Leaking solenoid volume limit	341	floating point	R	nnn			
Leaking solenoid timeout period	342	integer	R	nn			
No activity timeout alarm action	370	enumeration (see section 15.2.1.2)	R	n	0	2	
No activity timeout period	371	integer	R	nnn			
Active alarms	802	bitmask (see section 15.2.1.8)	R	hhhh			
Permissive state	804	enumeration (see section 15.2.1.3)	R	n	0	1	
Solenoid close delay	805	integer	R	nnnn			
Additive stream flow rate	809	floating point	R	nnnnn			
Accumulative wild stream gross observed volume	810	floating point	R	nnnnnnn			
Accumulative total additive stream gross observed volume	850	floating point	R	nnnnnnn			

Parameter Name	Param. Number	Parameter Format	Access	Format	Min.	Max.	Default
Accumulative transactional additive stream gross observed volume	860	floating point	R	nnnnnnn			
Accumulative leaking solenoid gross observed volume	870	floating point	R	nnnnnnn			
Accumulative calibration gross observed volume	880	floating point	R	nnnnnnn			
Load stream flow rate	881	floating point	R	nnnnn.nnn			
Additive stream flow rate	882	floating point	R	nnnnn.nnn			
Transaction PPM	883	floating point	R	nnnnn			
Task register	888	integer (see section 15.2.1.1)	W	hhhh			
Firmware version number	890	string	R	aaaaaa			
Product ID	892	string	R	aaaaaaaaa			
Device serial number	893	string	R	ssssssss			

6.3 Fusion4 SSC-B

TABLE 6-4 lists the parameters of the Brooks Petrocount protocol for the Fusion4 SSC-B (Single Stream Controller for Blending). See section 15.1 for a description of the parameters.

TABLE 6-4 Brooks PetroCount Protocol Parameters for Fusion4 SSC-B

Parameter Name	Param. Number	Parameter Format	Access	Format	Min.	Max.	Default
Wild stream K-factor	001	floating point	R	nnnnn.nnn			100
Blend stream K-factor	002	floating point	R	nnnnn.nnn			750
Target blend percentage rate A	010	floating point	R/W	nnn.nn			0
Target blend percentage rate B	011	floating point	R/W	nnn.nn			0

Parameter Name	Param. Number	Parameter Format	Access	Format	Min.	Max.	Default
Target blend percentage rate C	012	floating point	R/W	nnn.nn			0
Target blend percentage rate D	013	floating point	R/W	nnn.nn			0
Target blend percentage rate E	014	floating point	R/W	nnn.nn			0
Dead band control window limit	020	floating point	R/W	nnnn.nn	0.01	10000	0.1
Inner control window limit	021	floating point	R	nnnn.nn	0.01	10000	1
Middle control window limit	022	floating point	R	nnnn.nn	0.01	10000	10
Outer control window limit	023	floating point	R	nnnn.nn	0.01	10000	100
Solenoid active dwell	030	integer	R	nnnn	50	1000	100
Solenoid rest dwell	031	integer	R	nnnn	50	1000	100
Permissive function	040	enumeration (see section 15.2.2.10)	R	n	0	1	1
Blend stream pulse timeout	041	integer	R	nn	1	90	2
Wild stream pulse timeout	042	integer	R	nnn	1	999	5
Deviation count smoothing value	044	integer	R	nn	0	12	10
Reset blend deviation counter at transaction start	045	enumeration (see section 15.2.2.6)	R	n	0	1	0
Multifunction DC output #1	049	enumeration (see section 15.2.2.5)	R	n	2	5	2
Multi function DC output #2	050	enumeration (see section 15.2.2.5)	R	n	2	5	2
Preset gross observed volume	060	floating point	R/W	nnnnnn	0	999999	0
Flush volume	061	floating point	R/W	nnn	0	999	0
Pre-shutdown control	062	enumeration	R	n	0	2	0
Pre-shutdown volume	063	floating point	R/W	nnnn	0	9999	0
Clean start control	070	enumeration (see section 15.2.2.8)	R	n	0	1	0

Parameter Name	Param. Number	Parameter Format	Access	Format	Min.	Max.	Default
Blend point relative to wild stream meter	080	enumeration (see section 15.2.2.3)	R	n	0	1	0
Gross standard volume calculation interval	082	floating point	R	nnnn.nn			
Temperature compensation used	083	boolean	R	n			
Unit address	100	integer	R	nnn			
Broadcast address	101	integer	R	nnn			
DI hysteresis time	132	integer	R	nnnn			
Calibration high flow rate	200	floating point	R	nnnn	1	9999	60
Calibration low flow rate	201	floating point	R	nnn	1	100	15
Calibration inner control window limit	210	integer	R	nnn	1	100	10
Calibration outer flow rate control window	211	integer	R	nnnn	1	9999	25
Calibration start low flow volume	220	floating point	R	nnnn	1	9999	25
Calibration end low flow volume	221	floating point	R	nnnn	1	9999	25
Calibration final shut down volume	230	floating point	R	nnn	0	999	20
Flow calculation smoothing value	240	integer	R	nn	1	99	10
Control failure alarm action	310	enumeration (see section 15.2.2.2)	R	n	0	2	2
Control failure alarm timeout	311	integer	R	nn	1	30	10
Blend percentage deviation alarm action	320	enumeration (see section 15.2.2.2)	R	n	0	2	2
Blend low percentage allowed	321	integer	R/W	nn	1	99	95
Blend high percentage allowed	322	integer	R/W	nnn	101	999	105
Minimum wild stream volume for alarm	323	floating point	R/W	nnn	1	999	5
Leaking blend valve alarm action	340	enumeration (see section 15.2.2.2)	R	n	0	2	2

Parameter Name	Param. Number	Parameter Format	Access	Format	Min.	Max.	Default
Leaking blend valve volume limit	341	floating point	R	nnnn	1	9999	100
Wild stream closing volume alarm action	350	enumeration (see section 15.2.2.2)	R	n	0	2	2
Wild stream closing volume	351	floating point	R	nnnn	1	9999	150
Blend stream closing timeout alarm action	360	enumeration (see section 15.2.2.2)	R	n	0	2	2
Blend stream closing timeout	361	integer	R	nnn	1	240	60
No activity alarm action	370	enumeration (see section 15.2.2.2)	R	n	0	2	2
No activity timeout	371	integer	R	nn	1	65535	30
Flush volume alarm action	380	enumeration (see section 15.2.2.2)	R	n	0	2	2
Flush volume deviation	381	integer	R/W	nnn	1	100	25
Active alarms	802	integer (see section 15.2.2.18)	R	hhhh	0	65535	0
Permissive state	804	enumeration (see section 15.2.2.4)	R	n	0	1	0
Accumulative wild stream gross observed volume	810	floating point	R	nnnnnnnn	0	99999999	0
Accumulative blend stream gross observed volume	820	floating point	R	nnnnnnnn	0	99999999	0
Accumulative blend stream gross standard volume	825	floating point	R	nnnnnnnn	0	99999999	0
Transactional wild stream gross observed volume	830	floating point	R	nnnnnn.nn	0	999999.99	0
Transactional blend stream gross observed volume	840	floating point	R	nnnnnn.nn	0	999999.99	0
Transactional blend stream gross standard volume	845	floating point	R	nnnnnn.nn	0	999999.99	0

Parameter Name	Param. Number	Parameter Format	Access	Format	Min.	Max.	Default
Transactional blend percentage (normal mode)	850	floating point	R	nnn.nn	0	100.00	0
Accumulative blend volume (emulation mode only)	850	floating point	R	nnnnnnnn	0		0
Transaction deviation count	860	floating point	R	nnnnn			0
Transaction current average temperature	865	floating point	R	nnn.n	-999.9	999.9	0
Instantaneous temperature	866	floating point	R	nnn.n	-999.9	999.9	0
Accumulative leaking blend stream gross observed volume	870	floating point	R	nnnnnnnn	0	99999999	0
Accumulative calibration gross observed volume	880	floating point	R	nnnnnnnn	0	99999999	0
Wild stream flow rate	881	floating point	R	nnnn			
Blend stream flow rate	882	floating point	R	nnnn			
Transactional blend percentage	883	floating point	R	nnnn			
Task register	888	enumeration (see section 15.2.2.1)	W		1	802	
Firmware version number	890	string	R	aaaaaa			
Product ID	892	string	R	aaaaaaaaa			
Device serial number	893	string	R	aaaaaaaa			

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CHAPTER 7MODBUS PROTOCOLS

7.1 General

Modbus is a widely recognized protocol in industrial applications. It is an open protocol supported by the Modbus Organization (www.modbus.org), which provides technical specifications.

With regard to the Fusion4 controllers, three variations of Modbus protocol implementation can be distinguished:

- Modbus RTU is the standard Modbus protocol over serial communication line with RTU (Remote Terminal Unit) framing. It has its own data map. See section 7.1.1.
- Modbus Legacy uses Modbus RTU framing but handles data/ messages in a non-standard way. It has its own data map to provide backward compatibility where older instruments were used. See section 7.1.2.
- Modbus TCP/IP is the standard Modbus TCP/IP protocol. Data mapping and command interpretation are the same as per Modbus RTU. See section 13.1.

7.1.1 Modbus RTU

Modbus RTU is an application layer messaging protocol that provides client/server communications between devices connected on different types of buses or networks.

Modbus RTU is a request/reply protocol and offers services specified by function codes. Modbus function codes are elements of Modbus request/reply protocol data units (PDUs).

Modbus RTU over serial line is a master-slaves protocol. Only one master (at the same time) is connected to the bus, and one or several (247 maximum number) slaves nodes are also connected to the same serial bus. A Modbus communication is always initiated by the master. The slave nodes will never transmit data without receiving a request from the master node. The slave nodes will never communicate with each other. The master node initiates only one Modbus transaction at the same time.

The master node issues a Modbus request to the slave nodes in two modes:

- Unicast mode
  In this mode, the master node addresses an individual slave node. After receiving and processing the request, the slave returns a message (response) to the master. Each slave must have a unique address (from 1 to 247) so that it can be addressed independently from other nodes.

- Broadcast mode
  In this mode, the master can send a request to all slaves. No response is returned to broadcast requests sent by the master. Broadcast requests are necessarily writing commands. All slaves must accept the broadcast request for writing function. The address 0 is reserved to identify a broadcast exchange.

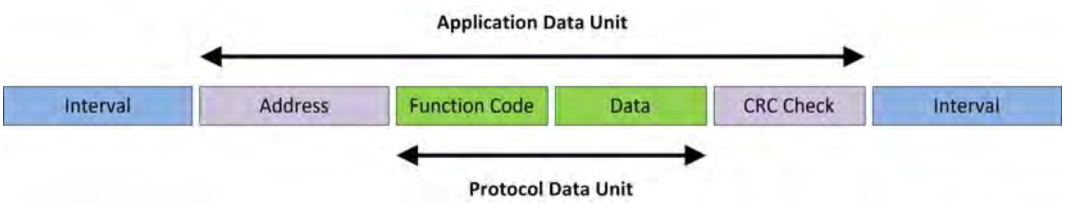
At the physical level Modbus RTU over serial line may use different physical interfaces with Fusion4 devices providing the most common TIA/EIA-485 (RS-485) interface.

7.1.1.1 Message format

In RTU mode, a message starts with a silent interval of at least 3.5 character times. Following the last transmitted character, a similar interval of at least 3.5 character times marks the end of the message. A new message can begin after this interval. The entire message frame must be transmitted as a continuous stream. If a silent interval of more than 1.5 character times occurs between two characters, the message frame is declared incomplete and will be discarded by the receiver.

Modbus RTU defines a simple protocol data unit (PDU) independent of the underlying communication layers. The mapping of the Modbus protocol on specific buses or network can introduce some additional fields on the application data unit. (ADU).

NOTE: *By default, the numerical data values within messages are placed in big endian format, i.e. higher order byte first, but Fusion4 devices allow an option for reversed byte order (little endian format) for greater flexibility when working with different masters. The examples in this chapter are based on the default big endian format for numerical data values within messages.*



Term	Description
Address	The Address field only contains the address of the slave. • The address of the slave is programmable in the range from 1 to 247. • 0 = Broadcast, no response required from slaves. • The range 248 to 255 is reserved. • When the slave returns its response, it places its own address in the response address field to let the master know which slave is responding,

Term	Description
Function	The function code indicates to the slave device what kind of action to perform: • 03 = Read holding register(s), see section 7.1.1.1.1 • 06 = Write single holding register, see section 7.1.1.1.2 • 16 = Write multiple holding registers, see section 7.1.1.1.3
Data	The data field contains additional information that the slave uses to take the action defined by the function code. This can include items like discrete and register addresses, the quantity of items to be handled, and the count of actual data bytes in the field.
CRC Check	The error–checking field is based on a Cyclical Redundancy Checking (CRC) method performed on the message contents. The CRC field checks the contents of the entire message. It is applied regardless of any parity checking method used for the individual characters of the message. The CRC field is appended to the message as the last field in the message. When this is done, the low–order byte of the field is appended first, followed by the high–order byte. The CRC high–order byte is the last byte to be sent in the message. The CRC value is calculated by the sending device, which appends the CRC to the message. The receiving device recalculates a CRC during receipt of the message, and compares the calculated value to the actual value it received in the CRC field. If the two values are not equal, an error results.

When a master sends a query to a slave, it expects a normal response. One of four possible events can occur from the master’s query:

- If the slave receives the query without a communication error and can handle the query normally, it returns a normal response (See details below).
- If the slave does not receive the query due to a communication error, no response is returned. The master has to process a timeout condition for the query.
- If the slave receives the query, but detects a communication error (parity or CRC), no response is returned. The master has to process a timeout condition for the query.
- If the slave receives the query without a communication error, but cannot handle it (e.g. if the request is to read a nonexistent register), the slave will return an exception informing the master of the nature of the error. See section 7.1.1.2.

7.1.1.1.1 *Function code 03 (0x03): Read Holding Registers*

Function code 03 (0x03) is used to read the contents of a contiguous block of holding registers in a slave. The request PDU specifies the starting address and the number of holding registers. In the PDU, holding registers are addressed starting at zero. Therefore, holding registers numbered 1-16 are addressed as 0-15.

The holding register data in the response message are packed as two bytes per holding register, with the binary contents right justified within each byte (the default byte order is big endian).

Request

Function code	1 byte	**0x03**
Starting address	2 bytes	0x0000 to 0xFFFF
Quantity of registers	2 bytes	1 to 125 (0x7D)

Response

Function code	1 byte	**0x03**
Byte count	1 byte	2 x **N***
Register value	**N*** x 2 bytes	

***N** = Quantity of registers

Example

Below is an example of a request to read holding registers 108 to 110.

Request		**Response**	
Field Name	*(Hex)*	*Field Name*	*(Hex)*
Function	03	Function	03
Starting address Hi	00	Byte count	06
Starting address Lo	6B	Register value Hi (108)	02
Quantity of registers Hi	00	Register value Lo (108)	2B
Quantity of registers Lo	03	Register value Hi (109)	00
		Register value Lo (109)	00
		Register value Hi (110)	00
		Register value Lo (110)	64

The contents of holding registers 108 to 110 are shown as the two-byte value of 02 2B hex (555 decimal), 00 00 hex (0 decimal) and 00 64 hex (100 decimal) respectively.

7.1.1.1.2 *Function code 06 (0x06): Write Single Holding Register*

Function code 06 (0x06) is used to write a single holding register in a slave. The request PDU specifies the address of the holding register to be written. In the PDU, holding registers are addressed starting at zero. Therefore, holding register numbered 1 is addressed as 0.

The normal response is an echo of the request, returned after the holding register contents have been written.

Request

Function code	1 Byte	**0x06**
Register address	2 Bytes	0x0000 to 0xFFFF
Register value	2 Bytes	0x0000 to 0xFFFF

Response

Function code	1 Byte	**0x06**
Register address	2 Bytes	0x0000 to 0xFFFF
Register value	2 Bytes	0x0000 to 0xFFFF

Error

Error code	1 Byte	**0x86**
Exception code	1 Byte	01 or 02 or 03 or 04 or 05 or 06

Example

Below is an example of a request to write holding register 2 to 00 03 hex.

Request		**Response**	
Field Name	*(Hex)*	*Field Name*	*(Hex)*
Function	06	Function	06
Register address Hi	00	Register address Hi	00
Register address Lo	01	Register address Lo	01
Register value Hi	00	Register value Hi	00
Register value Lo	03	Register value Lo	03

7.1.1.1.3 *Function code 16 (0x10): Write Multiple Registers*

Function code 16 (0x10) is used to write a block of contiguous registers (1 to 123 registers) in a slave. The requested written values are specified in the Request data field. Data is packed as two bytes per register. The normal response returns the function code, starting address, and quantity of holding registers written.

NOTE: *Fusion4 implementation of this function allows only one mapped parameter to be written per request (a parameter can occupy one or more registers).*

Request

Function code	1 Byte	**0x10**
Starting address	2 Bytes	0x0000 to 0xFFFF
Quantity of registers	2 Bytes	0x0001 to 0x007B
Byte count	1 Byte	2 x **N***
Registers value	**N*** x 2 Bytes	Value

*__N__ = Quantity of registers

Response

Function code	1 Byte	**0x10**
Starting address	2 Bytes	0x0000 to 0xFFFF
Quantity of registers	2 Bytes	1 to 123 (007B)

Error

Error code	1 Byte	**0x90**
Exception code	1 Byte	01, 02, 03, 04, 05 or 06

Example

Below is an example of a request to write two holding registers starting at 2 to 00 0A hex and 01 02 hex.

Request		**Response**	
Field Name	*(Hex)*	*Field Name*	*(Hex)*
Function	10	Function	10
Starting address Hi	00	Starting address Hi	00
Starting address Lo	01	Starting address Lo	01
Quantity of registers Hi	00	Quantity of registers Hi	00
Quantity of registers Lo	02	Quantity of registers Lo	02
Byte count	04		
Registers value Hi	00		
Registers value Lo	0A		
Registers value Hi	01		
Registers value Lo	02		

7.1.1.2 Exception Responses

When a client device sends a request to a server device it expects a normal response. One of four possible events can occur from the master’s query:

- If the slave device receives the request without a communication error, and can handle the query normally, it returns a normal response.
- If the slave device does not receive the request due to a communication error, no response is returned. The client program will eventually process a timeout condition for the request.
- If the slave device receives the request, but detects a communication error (parity, CRC, ...), no response is returned. The client program will eventually process a timeout condition for the request.
- If the slave device receives the request without a communication error, but cannot handle it (for example, if the request is to read a non-existent output or register), the slave device will return an exception response informing the client of the nature of the error.

The exception response message has two fields that differentiate it from a normal response:

- **Function Code Field:** In a normal response, the slave device echoes the function code of the original request in the function code field of the response. All function codes have a most-significant bit (MSB) of 0 (their values are all below 80 hexadecimal). In an exception response, the server sets the MSB of the function code to 1. This makes the function code value in an exception response exactly 80 hexadecimal higher than the value would be for a normal response.

  With the function code’s MSB set, the client's application program can recognize the exception response and can examine the data field for the exception code.

- **Data Field:** In a normal response, the server may return data or statistics in the data field (any information that was requested in the request). In an exception response, the server returns an exception code in the data field. This defines the server condition that caused the exception.

Example of a client request and server exception response.

Request		Response	
Field Name	*(Hex)*	*Field Name*	*(Hex)*
Function	03	Function	83
Starting address Hi	00	Exception code	02
Starting address Lo	6B		
Quantity of registers Hi	00		
Quantity of registers Lo	03		

In this example, the client addresses a request to a server device. The function code (03) is for a Read Holding Registers operation. It requests to read the contents of holding registers 108 (006B hex) to 110.

If the output address is non-existent in the server device, the server will return the exception response with the exception code shown (02). This specifies an illegal data address for the slave.

TABLE 7-1 lists the exception codes.

TABLE 7-1 Modbus Exception Codes

Code	Name	Description
01	Illegal function	The function code received in the query is not an allowable action for the server (or slave). This may be because the function code is only applicable to newer devices, and was not implemented in the unit selected. It could also indicate that the server (or slave) is in the wrong state to process a request of this type, for example because it is not configured and is being asked to return register values.
02	Illegal data address	The data address received in the query is not an allowable address for the server (or slave). More specifically, the combination of reference number and transfer length is invalid. For a controller with 100 registers, the PDU addresses the first register as 0, and the last one as 99. If a request is submitted with a starting register address of 96 and a quantity of registers of 4, then this request will successfully operate (address-wise at least) on registers 96, 97, 98, 99. If a request is submitted with a starting register address of 96 and a quantity of registers of 5, then this request will fail with Exception Code 0x02 “Illegal Data Address” since it attempts to operate on registers 96, 97, 98, 99 and 100, and there is no register with address 100.
03	Illegal data value	A value contained in the query data field is not an allowable value for server (or slave). This indicates a fault in the structure of the remainder of a complex request, such as that the implied length is incorrect. It specifically does NOT mean that a data item submitted for storage in a register has a value outside the expectation of the application program, since the MODBUS protocol is unaware of the significance of any particular value of any particular register.

Code	Name	Description
04	Slave device failure	An unrecoverable error occurred while the slave was attempting to perform the requested action.
05	Acknowledge	Specialized use in conjunction with programming commands. The server (or slave) has accepted the request and is processing it, but a long duration of time will be required to do so. This response is returned to prevent a timeout error from occurring in the client (or master). The client (or master) can next issue a Poll Program Complete message to determine if processing is completed.
06	Slave device busy	Specialized use in conjunction with programming commands. The server (or slave) is engaged in processing a long-duration program command. The client (or master) should retransmit the message later when the server (or slave) is free.

7.1.1.3 Executing a Task

Fusion4 devices allow to execute tasks by writing specific values into Parameter # 2000. This parameter can be used as a task register by a client using Modbus RTU protocol. By setting a bit in a single word written to the Parameter # 2000 register, various tasks can be executed (See Appendix A for possible task values).

Example

Execute Task “Enable Permissive” in unit address 123 (write value 0002h into register # 2000 using Modbus Function code 10h).

Request 7Bh	10h	07h	D0h	00h	01h	02h	00h	02h	CRC-H 59	CRC-L A3

Term	Description
7B	Address of the controller
10	Write command
07 D0	Parameter (2000)
00 01	# of words to write (in this case = 1 word)
02	# of bytes to write (in this case = 2 bytes)
00 02	Data to write
59 A3	CRC

Response 7Bh	10h	07h	D0h	00h	01h	CRC-H	CRC-L

7.1.2 Modbus Legacy

The Modbus Legacy protocol is a modified subset of Modbus Protocol, where commands adhere to the message framing defined by Modbus RTU (See section 7.1.1), but are not necessarily used for the same purpose.

For example, function code 06h is defined by Modbus to ‘Preset a Single Register’, while Modbus Legacy protocol use this function code to ‘Execute a Task’.

This version of protocol is provided for backward compatibility where older instruments (such as MiniPak 3000) were used and it has its own data map. Several points should be noted when using Modbus Legacy protocol:

- The location of the decimal point is fixed for each parameter. The location of the decimal point is governed by the parameter scaling factor. The scaling factor is the integer number by which the parameter value should be divided to get the real value of the parameter.
- String data is transmitted in the order in which they would be ‘read’ (i.e. from left to right). For example, ‘Premium’ is transmitted with the ‘P’ first and the ‘m’ last. String data is ‘null’ terminated within the data field. See example 2 below.
- All numbers in this section are decimal (base 10), unless otherwise specified. All hexadecimal numbers are followed by ‘h’.

7.1.2.1 Read and Write Commands

7.1.2.1.1 Read a Parameter (Command Code - 03h)

This function code is modified to allow only one mapped parameter to be read per request.

Examples

Example 1. Master wants to read parameter 001 in unit address 145. Parameter 001 has a value of 0345.243.

Request 91h	03h	00h	01h	00h	02h	CRC-H	CRC-L

Response 91h	03h	04h	00h	05h	44h	9Bh	CRC-H	CRC-L

Example 2. Master wants to read parameter 110 in unit address 145. Parameter 110 has a value of ‘06/22/95’.

Request 91h	03h	00h	6Eh	00h	05h	CRC-H	CRC-L

Response 91h	03h	0Ah	30h	36h	2Fh	32h	32h	2Fh	39h	35h	00h	00h	CRC-L	CRC-R

7.1.2.1.2 Write a Parameter (Command Code - 10h)

This function code is modified to allow only one mapped parameter to be altered per request.

Example

Master wants to set Parameter # 132 to 750 in unit address 145.

Request 91h	10h	00h	84h	00h	01h	02h	02h	EEh	CRC-H	CRC-L

Response 91h	10h	00h	84h	00h	01h	CRC-H	CRC-L

7.1.2.2 Executing a Task

Two methods exist for executing a Task when utilizing Modbus Legacy protocol. Both methods allow only one task to be executed per request.

- One method (preferred) uses Modbus Function code 10h where writing various values into a specific register (Parameter # 888) would initiate different tasks. See section 7.1.2.2.1.
- The other method is provided for compatibility with previous implementations and utilizes Modbus Function code 06h which is not used in the same manner as defined by Modbus. The task execution is determined by Parameter number and the two 'data bytes' are ignored by the slave device. They can be set to any value and will be echoed back to the master unit in the response packet. See section 7.1.2.2.2.

7.1.2.2.1 Execute a Task via Modus Function Code 10h

This method allows to execute tasks by writing specific values into Parameter # 888 via Modbus Function code 10h. This parameter can be used as a task register by a client using Modbus Legacy protocol. By setting a bit in a single word written to the Parameter # 888 register, various tasks can be executed (See Appendix A for possible task values).

Example

Execute Task “Enable Permissive” in unit address 123 (write value 0002h into Parameter # 888 using Modbus Function code 10h).

Request 7Bh	10h	03h	78h	00h	01h	02h	00h	02h	CRC-H 05	CRC-L 8B

Term	Description
7B	Address of the controller
10	Write command
03 78	Parameter (888)
00 01	# of words to write (in this case = 1 word)
02	# of bytes to write (in this case = 2 bytes)
00 02	Data to write
05 8B	CRC

Response 7Bh	10h	03h	78h	00h	01h	CRC-H	CRC-L

7.1.2.2.2 *Execute a Task via Modbus Function Code 06h*

This method allows to execute tasks by writing into specific Parameters (registers) via Modbus Function code 06h (data value is ignored). By setting a specific Parameter number, various tasks can be executed (See Appendix A for possible tasks and associated Parameter numbers).

Example

Execute task "Clear Additive Totals" in unit address 192 (write arbitrary value 0000h into Parameter # 802 using Modbus Function code 06h).

Request C0h	06h	03h	22h	00h	00h	CRC-H	CRC-L

Response C0h	06h	03h	22h	00h	00h	CRC-H	CRC-L

7.2 Modbus Legacy Protocol Mapping

7.2.1 Fusion4 SSC-A

TABLE 7-2 lists the Modbus Legacy Protocol parameters for the Fusion4 SSC-A (Single Stream Controller for Additive Injection). See section 15.1 for a description of the parameters.

TABLE 7-2 Modbus Legacy Protocol Parameters for Fusion4 SSC-A

Parameter Name	Starting Holding Register				Data Size / Type		Access	Scal-ing Factor	Range	Default
	Address (Parameter Equivalent)		Number (Standard / Modicon)		Regis-ters	Type				
Wild stream K-factor	001	0001	002	40002	2	uint32	R	1000		
Additive K-factor	002	0002	003	40003	2	uint32	R	1000		
Injection volume	010	000A	011	40011	2	uint32	R/W	1000		
Volume per injection cycle	020	0014	021	40021	2	uint32	R/W	10		
Solenoid dwell time	030	001E	031	40031	1	uint16	R	1		
Minimum transaction volume	040	0028	041	40041	2	uint32	R/W	1		
Factored pulse output resolution	050	0032	051	40051	1	uint16 (enum)	R	1	See section 15.2.1.5	
Number of clean start cycles	060	003C	061	40061	1	uint16	R/W	1		
Flush volume	061	003D	062	40062	2	uint32	R/W	1		
High flow threshold value	063	003F	064	40064	2	uint32	R/W	1		
Low flow threshold value	064	0040	065	40065	2	uint32	R/W	1		
Transaction closing time	065	0041	066	40066	1	uint16	R/W	1		

Parameter Name	Starting Holding Register				Data Size / Type		Access	Scaling Factor	Range	Default
	Address (Parameter Equivalent)		Number (Standard / Modicon)		Registers	Type				
Pacing source	080	0050	081	40081	1	uint16 (enum)	R	1	See section 15.2.1.4	
Permissive function	081	0051	082	40082	1	uint16 (enum)	R/W	1	See section 15.2.1.6	
Injection offset	090	005A	091	40091	1	uint16	R/W	1		
Unit address	100	0064	101	40101	1	uint16	R	1		
Broadcast address	101	0065	102	40102	1	uint16	R	1		
Number of solenoid retries	131	0083	132	40132	1	uint16	R	1		
DI hysteresis time	132	0084	133	40133	1	uint16	R	1		
Feedback pulse duration	133	0085	134	40134	1	uint16	R	1		
Pump run timeout	134	0086	135	40135	1	uint16	R/W	1		
No additive alarm action	310	0136	311	40311	1	uint16 (enum)	R	1	See section 15.2.1.2	
No additive timeout period	311	0137	312	40312	1	uint16	R	1		
Additive volume deviation alarm action	320	0140	321	40321	1	uint16 (enum)	R	1	See section 15.2.1.2	
Additive volume deviation allowed	322	0142	323	40323	1	uint16	R/W	1		
Leaking solenoid alarm action	340	0154	341	40341	1	uint16 (enum)	R	1	See section 15.2.1.2	
Leaking solenoid volume limit	341	0155	342	40342	1	uint16	R	1		
Leaking solenoid timeout period	342	0156	343	40343	1	uint16	R	1		

Parameter Name	Starting Holding Register				Data Size / Type		Access	Scal-ing Factor	Range	Default
	Address (Parameter Equivalent)		Number (Standard / Modicon)		Regis-ters	Type				
No activity timeout alarm action	370	0172	371	40371	1	uint16 (enum)	R	1	See section 15.2.1.2	
No activity timeout period	371	0173	372	40372	1	uint16	R	1	1 - 65535	
Active alarms	802	0322	803	40803	1	uint16 (enum)	R	1	See section 15.2.1.8	
Permissive state	804	0324	805	40805	1	uint16 (enum)	R	1	See section 15.2.1.3	
Solenoid close delay	805	0325	806	40806	1	uint16	R	1		
Additive stream flow rate	809	0329	810	40810	2	uint32	R	1		
Accumulative wild stream gross observed volume	810	032A	811	40811	2	uint32	R	1		
Accumulative total additive stream gross observed volume	850	0352	851	40851	2	uint32	R	1000		
Accumulative transactional additive stream gross observed volume	860	035C	861	40861	2	uint32	R	1000		
Accumulative leaking sole-noid gross observed volume	870	0366	871	40871	2	uint32	R	1000		
Accumulative calibration gross observed volume	880	0370	881	40881	2	uint32	R	1000		
Load stream flow rate	881	0371	882	40882	2	uint32	R	1		

Parameter Name	Starting Holding Register				Data Size / Type		Access	Scal-ing Factor	Range	Default
	Address (Parameter Equivalent)		Number (Standard / Modicon)		Regis-ters	Type				
Additive stream flow rate	882	0372	883	40883	2	uint32	R	1		
Transaction PPM	883	0373	884	40884	2	uint32	R	1		
Transactional load stream gross obser-ved volume	885	0375	886	40886	2	uint32	R	1		
Task register	888	0378	889	40889	1	uint16 (enum)	W	1	See section 15.2.2.1	
Firmware ver-sion number	890	037A	891	40891	**3**	string	R	1		
Product ID	892	037C	893	40893	5	string	R	1		
Device serial number	893	037D	894	40894	4	string	R	1		

7.2.1.1 Definition of Fusion4 SSC-A Volume Parameters

TABLE 7-3 provides a definition of the Fusion4 SSC-A volume parameters.

TABLE 7-3 Definition of Fusion4 SSC-A volume parameters

Parameter Number	Parameter Name	Parameter Number			
		Acc. wild stream volume	Acc. additive volume	Acc. calibration volume	Acc. leaking volume
810	Accumulative wild stream gross observed volume	✔			
850	Accumulative total additive stream gross observed volume		✔	✔	✔
860	Accumulative transactional additive stream gross observed volume		✔		
870	Accumulative leaking solenoid gross observed volume				✔
880	Accumulative calibration gross observed volume			✔	

7.2.2 Fusion4 SSC-B

TABLE 7-4 lists the Modbus Legacy Protocol parameters for the Fusion4 SSC-B (Single Stream Controller for Blending). See section 15.1 for a description of the parameters.

TABLE 7-4 Modbus Legacy Protocol Parameters for Fusion4 SSC-B

Param. Name	Starting Holding Register				Data Size / Type		Access	Scal-ing Factor	Range	Default
	Address (Parameter Equivalent)		Number (Standard / Modicon)		Regis-ters	Type				
Wild stream K-factor	001	0001	002	40002	2	uint32	R	1000	0.001 - 99999.999	100
Blend stream K-factor	002	0002	003	40003	2	uint32	R	1000	0.001 - 99999.999	50
Target blend percentage rate A	010	000A	011	40011	2	uint32	R/W	100	0 - 100	0
Target blend percentage rate B	011	000B	012	40012	2	uint32	R/W	100	0 - 100	0
Target blend percentage rate C	012	000C	013	40013	2	uint32	R/W	100	0 - 100	0
Target blend percentage rate D	013	000D	014	40014	2	uint32	R/W	100	0 - 100	0
Target blend percentage rate E	014	000E	015	40015	2	uint32	R/W	100	0 - 100	0
Dead band control win-dow limit	020	0014	021	40021	2	uint32	R/W	100	0.01 - 10000	0.1
Inner control window limit	021	0015	022	40022	2	uint32	R	100	0.01 - 10000	1
Middle con-trol window limit	022	0016	023	40023	2	uint32	R	100	0.01 - 10000	10
Outer control window limit	023	0017	024	40024	2	uint32	R	100	0.01 - 10000	100
Solenoid active dwell	030	001E	031	40031	1	uint16	R	1	50 - 1000	10

Param. Name	Starting Holding Register				Data Size / Type		Access	Scal-ing Factor	Range	Default
	Address (Parameter Equivalent)		Number (Standard / Modicon		Regis-ters	Type				
Solenoid rest dwell	031	001F	032	40032	1	uint16	R	1	50 - 1000	10
Permissive Function	040	0028	041	40041	1	uint16 (enum)	R	1	See section 15.2.1.6	0
Blend stream pulse timeout	041	0029	042	40042	1	uint16	R	1		
Wild stream pulse timeout	042	002A	043	40043	1	uint16	R	1		
Deviation count smoothing value	044	002C	045	40045	1	uint16	R	1		
Reset blend deviation counter at transaction start	045	002D	046	40046	1	uint16 (enum)	R	1	See section 15.2.2.6	
Multifunction DC output #1	049	0031	050	40050	1	uint16 (enum)	R	1	See section 15.2.2.5	
Multi function DC output #2	050	0032	051	40051	1	uint16 (enum)	R	1	See section 15.2.2.5	
Preset gross observed vol-ume	060	003C	061	40061	2	uint32	R/W	1		
Flush volume	061	003D	062	40062	2	uint32	R/W	1		
Pre-shut-down control	062	003E	063	40063	1	uint16 (enum)	R	1	See section 15.2.2.7	
Pre-shut-down volume	063	003F	064	40064	2	uint32	R/W	1		
Clean start control	070	0046	071	40071	1	uint16 (enum)	R	1	See section 15.2.2.8	
Blend point relative to wild stream meter	080	0050	081	40081	1	uint16 (enum)	R	1	See section 15.2.2.3	
Gross stan-dard volume calculation interval	082	0052	083	40083	2	uint32	R	100		

Param. Name	Starting Holding Register				Data Size / Type		Access	Scal-ing Factor	Range	Default
	Address (Parameter Equivalent)		Number (Standard / Modicon		Regis-ters	Type				
Temperature compensa-tion used	083	0053	084	40084	1	uint16 (bool)	R	1		
Unit address	100	0064	101	40101	1	uint16	R	1		
Broadcast address	101	0065	102	40102	1	uint16	R	1		
DI hysteresis time	132	0084	133	40133	1	uint16	R	1		
Calibration high flow rate	200	00C8	201	40201	2	uint32	R	1		
Calibration low flow rate	201	00C9	202	40202	2	uint32	R	1		
Calibration inner control window limit	210	00D2	211	40211	1	uint16	R	1		
Calibration outer flow rate control win-dow	211	00D3	212	40212	1	uint16	R	1		
Calibration start low flow volume	220	00DC	221	40221	2	uint32	R	1		
Calibration end low flow volume	221	00DD	222	40222	2	uint32	R	1		
Calibration final shut down volume	230	00E6	231	40231	2	uint32	R	1		
Flow calcula-tion smooth-ing value	240	00F0	241	40241	1	uint16	R	1		
Control fail-ure alarm action	310	0136	311	40311	1	uint16 (enum)	R	1	See section 15.2.2.2	
Control fail-ure alarm timeout	311	0137	312	40312	1	uint16	R	1		
Blend per-centage devi-ation alarm action	320	0140	321	40321	1	uint16 (enum)	R	1	See section 15.2.2.2	

Param. Name	Starting Holding Register				Data Size / Type		Access	Scal-ing Factor	Range	Default
	Address (Parameter Equivalent)		Number (Standard / Modicon		Regis-ters	Type				
Blend low percentage allowed	321	0141	322	40322	1	uint16	R/W	1		
Blend high percentage allowed	322	0142	323	40323	1	uint16	R/W	1		
Minimum wild stream vol-ume for alarm	323	0143	324	40324	2	uint32	R/W	1		
Leaking blend valve alarm action	340	0154	341	40341	1	uint16 (enum)	R	1	See section 15.2.2.2	
Leaking blend valve volume limit	341	0155	342	40342	2	uint16	R	1		
Wild stream closing vol-ume alarm action	350	015E	351	40351	1	uint16 (enum)	R	1	See section 15.2.2.2	
Wild stream closing vol-ume	351	015F	352	40352	2	uint32	R	1		
Blend stream closing time-out alarm action	360	0168	361	40361	1	uint16 (enum)	R	1	See section 15.2.2.2	
Blend stream closing time-out	361	0169	362	40362	1	uint16	R	1		
No activity alarm action	370	0172	371	40371	1	uint16 (enum)	R	1	See section 15.2.2.2	
No activity timeout period	371	0173	372	40372	1	uint16	R	1	1 - 65535	30
Flush volume alarm action	380	017C	381	40381	1	uint16 (enum)	R	1	See section 15.2.2.2	
Flush volume deviation	381	017D	382	40382	1	uint16	R/W	1		
Active alarms	802	0322	803	40803	1	uint16 (enum)	R	1		

Param. Name	Starting Holding Register				Data Size / Type		Access	Scal-ing Factor	Range	Default
	Address (Parameter Equivalent)		Number (Standard / Modicon		Regis-ters	Type				
Permissive state	804	0324	805	40805	1	uint16 (enum)	R	1	See section 15.2.2.4	
Accumulative wild stream gross obser-ved volume	810	032A	811	40811	2	uint32	R	1		
Accumulative blend stream gross observed vol-ume	820	0334	821	40821	2	uint32	R	1		
Accumulative blend stream gross stan-dard volume	825	0339	826	40826	2	uint32	R	100		
Transactional wild stream gross obser-ved volume	830	033E	831	40831	2	uint32	R	100		
Transactional blend stream gross obser-ved volume	840	0348	841	40841	2	uint32	R	100		
Transactional blend stream gross stan-dard volume	845	034D	846	40846	2	uint32	R	100		
Transactional blend per-centage	850	0352	851	40851	2	uint32	R	1000 / 100		
Transaction deviation count	860	035C	861	40861	2	uint32	R	1		
Transactional current aver-age tempera-ture	865	0361	866	40866	2	uint32	R	10		
Instanta-neous tem-perature	866	0362	867	40867	2	uint32	R	10		

Param. Name	Starting Holding Register				Data Size / Type		Access	Scal-ing Factor	Range	Default
	Address (Parameter Equivalent)		Number (Standard / Modicon		Regis-ters	Type				
Accumulative leaking blend stream gross observed vol-ume	870	0366	871	40871	2	uint32	R	1		
Accumulative calibration gross obser-ved volume	880	0370	881	40881	2	uint32	R	1		
Wild stream flow rate	881	0371	882	40882	2	uint32	R	1		
Blend stream flow rate	882	0372	883	40883	2	uint32	R	1		
Transactional blend per-centage	883	0373	884	40884	2	uint32	R	1		
Transactional load stream gross obser-ved volume	885	0375	886	40886	2	uint32	R	1		
Task register	888	0378	889	40889	1	uint16 (enum)	W	1	See section 15.2.2.1	
Firmware ver-sion number	890	037A	891	40891	3	string	R	1		
Product ID	892	037C	893	40893	3	string	R	1		
Device serial number	893	037D	894	40894	5	string	R	1		

7.2.2.1 Definition of Fusion4 SSC-B Volume Parameters

TABLE 7-5 provides a definition of the SSC-B volume parameters.

TABLE 7-5 Definition of Fusion4 SSC-B volume parameters

Parameter Number	Parameter Name	Acc. wild stream volume	Acc. blend stream volume	Acc. calibration volume	Acc. leaking volume
810	Accumulative wild stream gross observed volume	✔			
820	Accumulative total blend stream gross observed volume		✔		

Parameter Number	Parameter Name	Acc. wild stream volume	Acc. blend stream volume	Acc. calibration volume	Acc. leaking volume
825	Accumulative blend stream gross standard volume		✔		
870	Accumulative leaking solenoid gross observed volume				✔
880	Accumulative calibration gross observed volume			✔	

7.2.3 Fusion4 MSC-A

TABLE 7-6 lists the Modbus Legacy Protocol parameters for the Fusion4 MSC-A (Multi-Stream Controller for Additive Injection). See section 15.1 for a description of the parameters.

TABLE 7-6 Modbus Legacy Protocol Parameters for Fusion4 MSC-A

Parameter Name	Starting Holding Register				Data Size / Type		Access	Scaling Factor	Range	Default
	Address Parameter / Equivalent		Number (Standard / Modicon)		Registers	Type				
Wild stream K-factor	001	0001	002	40002	2	uint32	R/W	1000		
Additive K-factor	002	0002	003	40003	2	uint32	R/W	1000		
Injection volume	010	000A	011	40011	2	uint32	R/W	1000		
Volume per injection cycle	020	0014	021	40021	2	uint32	R/W	10		
Solenoid dwell time	030	001E	031	40031	1	uint16	R/W	1		
Minimum product volume for transaction	040	0028	041	40041	2	uint32	R/W	1		
Factored pulse output resolution	050	0032	051	40051	1	uint16 (enum)	R/W		See section 15.2.1.5	
Number of clean start cycles	060	003C	061	40061	1	uint16	R/W	1		

Parameter Name	Starting Holding Register				Data Size / Type		Access	Scal-ing Factor	Range	Default
	Address Parameter / Equivalent		Number (Standard / Modicon)		Regis-ters	Type				
Flush volume	061	003D	062	40062	2	uint32	R/W	1		
High flow threshold value	063	003F	064	40064	2	uint32	R/W	1		
Low flow threshold value	064	0040	065	40065	2	uint32	R/W	1		
Transaction closing time	065	0041	066	40066	1	uint16	R/W	1		
Pacing source	080	0050	081	40081	1	uint16 (enum)	R/W		See section 15.2.1.4	
Permissive function	081	0051	082	40082	1	uint16 (enum)	R		See section 15.2.1.6	
Injection off-set	090	005A	091	40091	1	uint16	R/W	1		
Unit address	100	0064	101	40101	1	uint16	R	1		
Number of solenoid retries	131	0083	132	40132	1	uint16	R/W	1		
Feedback pulse duration	133	0085	134	40134	1	uint16	R/W	1		
Pump run timeout	134	0086	135	40135	1	uint16	R/W	1		
No additive alarm action	310	0136	311	40311	1	uint16 (enum)	R/W		See section 15.2.1.2	
No additive flow timeout period	311	0137	312	40312	1	uint16	R/W	1		
Additive vol-ume devia-tion alarm action	320	0140	321	40321	1	uint16 (enum)	R/W		See section 15.2.1.2	
Additive vol-ume devia-tion allowed	322	0142	323	40323	1	uint16	R/W	1		
Additive devi-ation basis	323	0143	324	40324	1	uint16	R/W	1		

Parameter Name	Starting Holding Register				Data Size / Type		Access	Scal-ing Factor	Range	Default
	Address Parameter / Equivalent		Number (Standard / Modicon)		Regis-ters	Type				
Leaking solenoid alarm action	340	0154	341	40341	1	uint16 (enum)	R/W		See section 15.2.1.5	
Leaking sole-noid volume limit	341	0155	342	40342	1	uint16	R/W	1		
Leaking sole-noid timeout period	342	0156	343	40343	1	uint16	R/W	1		
No activity timeout alarm action	370	0172	371	40371	1	uint16 (enum)	R/W		See section 15.2.1.2	
No activity timeout period	371	0173	372	40372	1	uint16	R/W	1		
Slow flow vol-ume alarm action	380	017C	381	40381	1	uint16 (enum)	R/W		See section 15.2.1.2	
Active alarms	802	0322	803	40803	1	uint16 (enum)	R	1	See section 15.2.1.8	
Permissive state	804	0324	805	40805	1	uint16 (enum)	R		See section 15.2.1.6	
Solenoid close delay	805	0325	806	40806	1	uint16	R	1		
Alarm and permissive state (injec-tors 1 - 6)*****	806	0326	807	40807	1	uint16 (bits)	R			
Alarm and permissive state (injec-tors 7 - 12)*****	807	0327	808	40808	1	uint16 (bits)	R			
Additive stream flow rate	809	0329	810	40810	2	uint32	R	1		
Accumulative wild stream gross obser-ved volume	810	032A	811	40811	2	uint32	R	1		

Parameter Name	Starting Holding Register				Data Size / Type		Access	Scal-ing Factor	Range	Default
	Address Parameter / Equivalent		Number (Standard / Modicon)		Regis-ters	Type				
Accumulative total additive stream gross observed volume	850	0352	851	40851	2	uint32	R	1000		
Accumulative transactional additive stream gross observed volume	860	035C	861	40861	2	uint32	R	1000		
Accumulative leaking sole-noid gross observed volume	870	0366	871	40871	2	uint32	R	1000		
Accumulative calibration gross obser-ved volume	880	0370	881	40881	2	uint32	R	1000		
Load stream flow rate	881	0371	882	40882	2	uint32	R	1		
Additive stream flow rate	882	0372	883	40883	2	uint32	R	1		
Transaction PPM	883	0373	884	40884	2	uint32	R	1		
Transactional load stream gross obser-ved volume	885	0375	886	40886	2	uint32	R	1		
Task register	888	0378	889	40889	1	uint16 (enum)	W/R		See section 15.2.1.1	
Software ver-sion*	890	037A	891	40891	3	string	R			
Product ID*	892	037C	893	40893	5	string	R			
Device serial number*	893	037D	894	40894	4	string	R			

REMARK: The * (asterix) denotes global parameters affecting ALL injector channels.

7.2.3.1 Definition of Fusion4 MSC-A Volume Parameters

TABLE 7-3 provides a definition of the Fusion4 MSC-A volume parameters.

TABLE 7-7 Definition of Fusion4 MSC-A volume parameters

Parameter Number	Parameter Name	Parameter Number			
		810	860	870	880
810	Accumulative wild stream gross observed volume	✔			
850	Accumulative total additive stream gross observed volume		✔	✔	✔
860	Accumulative transactional additive stream gross observed volume		✔		
870	Accumulative leaking solenoid gross observed volume			✔	
880	Accumulative calibration gross observed volume				✔

7.2.4 Fusion4 MSC-L

=> Future implementation

7.3 Modbus RTU Protocol Mapping

7.3.1 Fusion4 SSC-A

TABLE 7-8 lists the Modbus RTU Protocol parameters for the Fusion4 SSC-A (Single Stream Controller for Additive Injection). See section 15.1 for a description of the parameters.

REMARK: In previous releases of the Fusion4 SSC-A Modbus RTU is known as Full Modbus.

TABLE 7-8 Modbus RTU Protocol Parameters for Fusion4 SSC-A

Param. Name	Starting Holding Register				Data Size/Type		Access	Range	Default
	Adress (Decimal/Hex)		Number (Standard/Modicon)		Registers	Type			
Accumulative additive stream gross observed volume	000	0000	001	40001	4	float64	R		

Param. Name	Starting Holding Register				Data Size/Type		Access	Range	Default
	Adress (Decimal/Hex)		Number (Standard/Modicon)		Registers	Type			
Transactional additive stream gross observed volume	004	0004	005	40005	4	float64	R		
Accumulative leaking solenoid gross observed volume	008	0008	009	40009	4	float64	R		
Accumulative calibration gross observed volume	012	000C	013	40013	4	float64	R		
Accumulative wild stream gross observed volume	016	0010	017	40017	4	float64	R		
Wild stream K-factor	100	0064	101	40101	2	float32	R		100,0
Additive K-factor	102	0066	103	40103	2	float32	R		750,0
Leaking solenoid volume limit	104	0068	105	40105	2	float32	R	0.0 - 999.99	0,1
Solenoid dwell time	200	00C8	201	40201	1	uint16	R	0 - 32767	0
Factored pulse output resolution	201	00C9	202	40202	1	unit 16 (enum)	R	See section 15.2.1.5	2
Pacing source	202	00CA	203	40203	1	uint16 (enum)	R	See section 15.2.1.4	
Unit address	203	00CB	204	40204	1	uint16	R	1 - 997	123
Broadcast address	204	00CC	205	40205	1	uint16	R		998
DI hysteresis time	205	00CD	206	40206	1	uint16	R	0 - 1000	250
Feedback pulse duration	206	00CE	207	40207	1	uint16	R	0 - 1000	500
Reserved	207	00CF	208	40208	1				
No additive alarm action	208	00D0	209	40209	1	uint16 (enum)	R	See section 15.2.1.2	

Param. Name	Starting Holding Register				Data Size/Type		Access	Range	Default
	Adress (Decimal/Hex)		Number (Standard/Modi-con)		Regis-ters	Type			
Additive volume deviation alarm action	209	00D1	210	40210	1	uint16 (enum)	R	See section 15.2.1.2	
Leaking solenoid alarm action	210	00D2	211	40211	1	uint16 (enum)	R	See section 15.2.1.2	
No activity timeout alarm action	211	00D3	212	40212	1	uint16 (enum)	R	See section 15.2.1.2	
Permissive state	212	00D4	213	40213	1	uint16 (enum)	R	See section 15.2.1.3	
Solenoid close delay	213	00D5	214	40214	1	uint16	R	500 - 10000	500
Active alarms	214	00D6	215	40215	1	uint16	R		
Permissive function	215	00D7	216	40216	1	uint16 (enum)	R	See section 15.2.1.6	
Reserved	300	012C	301	40301	1				
Number of solenoid retries	301	012D	302	40302	1	uint16	R	0 - 2	2
No additive flow timeout period	302	012E	303	40303	1	uint16	R	1 - 9	2
Leaking solenoid timeout period	303	012F	304	40304	1	uint16	R	1 - 99	60
No activity timeout period	304	0130	305	40305	1	uint16	R	1 - 65535	60
Injection volume	400	0190	401	40401	2	float32	R/W	0.10 - 9900.00	20.00
Volume per injection cycle	402	0192	403	40403	2	float32	R/W	0.001 - 9999.9	40.00
Minimum product volume for transaction	404	0194	405	40405	2	float32	R/W	1.00 - 999.00	10,00
Clean start gross observed volume	406	0196	407	40407	2	float32	R/W	0.00 - 999.00	0.00
High flow threshold value	408	0198	409	40409	2	float32	R/W	0.0 - 30000.0	1000.0
Low flow threshold value	410	019A	411	40411	2	float32	R/W	0.0 - 30000.0	1000.0

Param. Name	Starting Holding Register				Data Size/Type		Access	Range	Default
	Adress (Decimal/Hex)		Number (Standard/Modicon)		Registers	Type			
Number of clean start cycles	600	0258	601	40601	1	uint16	R/W	1 - 99	10
Injection offset	601	0259	602	40602	1	uint16	R/W	0 - 100	0
Pump start timeout	602	025A	603	40603	1	uint16	R/W	1 - 255	10
Additive volume deviation allowed	603	025B	604	40604	1	uint16	R/W	1 - 100	10
Transaction closing time	604	025C	605	40605	1	uint16	R/W	5 - 255	30
See section 7.3.1.1 for parameters with holding register 40801 through 41826.									
Task register	2000	07D0	2001	42001	1	unit 16 (enum)	W	See section 15.2.1.1	
See section 7.3.1.1 for parameters with holding register 42801 through 42826.									

7.3.1.1 Fusion4 SSC-A Modbus RTU Block

TABLE 7-9 lists the Modbus RTU Protocol parameters with holding register 40801 through 40840, 41801 through 41826, and 42801 through 42826 for the Fusion4 SSC-A (Single Stream Controller for Additive Injection). See section 15.1 for a description of the parameters.

REMARK: In TABLE 7-9, the following scaling factors apply to 32-bit integer type parameters:

Flow rate	x1000
Percentage	x100
Temperature	x100
Other	No scaling

TABLE 7-9 Modbus RTU Protocol Parameters for Fusion4 SSC-A (continued)

Parameter Name	Starting Holding Register				Data Size / Type		Access
	Address (Decimal / Hex)		Number (Std. / Modicon)		Registers	Type	
Additive stream state (See also section 15.2.1.7)	800	0320	801	40801	1	uint16	R
	1800	0708	1801	41801	1	uint16	
	2800	0AF0	2801	42801	1	uint16	

Parameter Name	Starting Holding Register				Data Size / Type		Access
	Address (Decimal / Hex)		Number (Std. / Modicon)		Regis-ters	Type	
Active alarms (See also section 15.2.1.8)	801	0321	802	40802	1	uint16	R
	1801	0709	1802	41802	1	uint16	
	2801	0AF1	2802	42802	1	uint16	
Accumulative total load stream gross observed volume	802	0322	803	40803	4	float64	R
	1802	070A	1803	41803	2	float32	
	2802	0AF2	2803	42803	2	int32	
Accumulative total additive stream gross observed volume	806	0326	807	40807	4	float64	R
	1804	070C	1805	41805	2	float32	
	2804	0AF4	2805	42805	2	int32	
Transactional load stream gross observed volume	810	032A	811	40811	4	float64	R
	1806	070E	1807	41807	2	float32	
	2806	0AF6	2807	42807	2	int32	
Transactional additive stream gross observed volume	814	032E	815	40815	4	float64	R
	1808	0710	1809	41809	2	float32	
	2808	0AF8	2809	42809	2	int32	
Product stream flow rate	818	0332	819	40819	4	float64	R
	1810	0712	1811	41811	2	float32	
	2810	0AFA	2811	42811	2	int32	
Additive stream flow rate	822	0336	823	40823	4	float64	R
	1812	0714	1813	41813	2	float32	
	2812	0AFC	2813	42813	2	int32	
Transaction PPM	826	033A	827	40827	4	float64	R
	1814	0716	1815	41815	2	float32	
	2814	AFE	2815	42815	2	int32	
Software version	830	33E	831	40831	4	char[8]	R
	1816	718	1817	41817	4	char[8]	
	2816	0B00	2817	42817	4	char[8]	
Product ID	834	0342	835	40835	5	char[10]	R
	1820	071C	1821	41821	5	char[10]	
	2820	0B04	2821	42821	5	char[10]	
Device serial number	839	0347	840	40840	4	char[8]	R
	1825	0721	1826	41826	4	char[8]	
	2825	0B09	2826	42826	4	char[8]	

7.3.2 Fusion4 SSC-B

TABLE 7-10 lists the Modbus RTU Protocol parameters for the Fusion4 SSC-B (Single Stream Controller for Blending). See section 15.1 for a description of the parameters.

REMARK: In previous releases of the Fusion4 SSC-B Modbus RTU is known as Full Modbus.

TABLE 7-10 Modbus RTU Protocol Parameters for Fusion4 SSC-B

Parameter Name	Starting Holding Register				Data Size / Type		Access	Range	Default
	Adress (Decimal / Hex)		Number (Std. / Modicon)		Regis-ters	Type			
Flush volume	000	0000	001	40001	4	float64	R/W	0.00 - 999.0	0.0
Reference tem-perature	004	0004	005	40005	4	float64	R/W		
Reference pres-sure	008	0008	009	40009	4	float64	R/W		
Blend product observed density	012	000C	013	40013	4	float64	R/W		0.0
Blend product observed temper-ature	016	0010	017	40017	4	float64	R/W		0.0
Blend product observed pres-sure	020	0014	021	40021	4	float64	R/W		0.0
Blend product expansion coeff	024	0018	025	40025	4	float64	R/W		0.0
VCF calculation interval volume	028	001C	029	40029	4	float64	R/W	1.0 - 1000.0	100.0
Recipe 1 target blend percentage	100	0064	101	40101	2	float32	R/W	0 - 100	0.0
Recipe 2 target blend percentage	102	0066	103	40103	2	float32	R/W	0 - 100	0.0
Recipe 3 target blend percentage	104	0068	105	40105	2	float32	R/W	0 - 100	0.0
Recipe 4 target blend percentage	106	006A	107	40107	2	float32	R/W	0 - 100	0.0
Recipe 5 target blend percentage	108	006C	109	40109	2	float32	R/W	0 - 100	0.0

Parameter Name	Starting Holding Register				Data Size / Type		Access	Range	Default
	Adress (Decimal / Hex)		Number (Std. / Modicon)		Regis-ters	Type			
Dead band control window limit	110	006E	111	40111	2	float32	R/W	0.01 - 10000.00	0.1
Preset gross observed volume	112	0070	113	40113	2	float32	R/W	0.0 - 999999.0	0.0
Pre-shutdown closure volume	114	0072	115	40115	2	float32	R/W	0.0 - 9999.0	0.0
Minimum wild stream flow for alarm	116	0074	117	40117	2	float32	R/W	1.0 - 999.0	5.0
Blend high percentage allowed	200	00C8	201	40201	1	uint16	R/W	101 - 999	105
Volume correction table	201	00C9	202	40202	1	uint16 (enum)	R/W	See section 15.2.2.11	
Commodity group	202	00CA	203	40203	1	uint16 (enum)	R/W	See section 15.2.2.12	
VCF options	203	00CB	204	40204	1	uint16 (enum)	R/W	See section 15.2.2.13	
Glass hydrometer used	204	00CC	205	40205	1	uint16 (enum)	R/W	See section 15.2.2.14	0
Reference temperature units	205	00CD	206	40206	1	uint16 (enum)	R/W	See section 15.2.2.15	
Reference pressure units	206	00CE	207	40207	1	uint16 (enum)	R/W	See section 15.2.2.16	
Blend low percentage allowed	300	012C	301	40301	1	uint16	R/W	1 - 99	95
Flush volume deviation	301	012D	302	40302	1	uint16	R/W	1 - 100	25
Temperature compensation used	302	012E	303	40303	1	uint16	R/W	0-1	
Pressure compensation used	303	012F	304	40304	1	uint16	R/W	0 - 1	
VCF calculation interval min	304	0130	305	40305	1	uint16	R/W	1 - 60	1
VCF calculation interval max	305	0131	306	40306	1	uint16	R/W	1 - 60	3
Reserved	400	0190	401	40401	4				

Parameter Name	Starting Holding Register				Data Size / Type		Access	Range	Default
	Adress (Decimal / Hex)		Number (Std. / Modicon)		Regis-ters	Type			
Calibration low flow volume	404	0194	405	40405	4	float64	R		
Calibration end flow volume	408	0198	409	40409	4	float64	R		
Calibration final shutdown volume	412	019C	413	40413	4	float64	R		
Accumulative wild stream gross observed volume	416	01A0	417	40417	4	float64	R		
Accumulative blend stream gross observed volume	420	01A4	421	40421	4	float64	R		
Accumulative blend stream gross standard volume	424	01A8	425	40425	4	float64	R		
Transactional wild stream gross observed volume	428	01AC	429	40429	4	float64	R		
Transactional blend stream gross observed volume	432	01B0	433	40433	4	float64	R		
Transactional blend stream gross standard volume	436	01B4	437	40437	4	float64	R		
Transaction devi-ation count	440	01B8	441	40441	4	float64	R		
Transaction cur-rent avg temp	444	01BC	445	40445	4	float64	R		
Instantaneous temp	448	01C0	449	40449	4	float64	R		
Instantaneous pressure	452	01C4	453	40453	4	float64	R		
Accumulative leaking blend stream gross observed volume	456	01C8	457	40457	4	float64	R		
Accumulative cali-bration gross observed volume	460	01CC	461	40461	4	float64	R		
Density (lab)	464	01D0	465	40465	4	float64	R		

Parameter Name	Starting Holding Register				Data Size / Type		Access	Range	Default
	Adress (Decimal / Hex)		Number (Std. / Modicon)		Regis-ters	Type			
Temperature (lab)	468	01D4	469	40469	4	float64	R		
Pressure (lab)	472	01D8	473	40473	4	float64	R		
Density (base)	476	01DC	477	40477	4	float64	R		
Temperature (base)	480	01E0	481	40481	4	float64	R		
Pressure (base)	484	01E4	485	40485	4	float64	R		
Volume (base)	488	01E8	489	40489	4	float64	R		
Density (observed)	492	01EC	493	40493	4	float64	R		
Temperature (observed)	496	01F0	497	40497	4	float64	R		
Pressure (observed)	500	01F4	501	40501	4	float64	R		
VCF lab to base	504	01F8	505	40505	4	float64	R		
VCF base to observed	508	01FC	509	40509	4	float64	R		
Compressibility factor	512	0200	513	40513	4	float64	R		
Expansion factor	516	0204	517	40517	4	float64	R		
Wild stream K- factor	700	02BC	701	40701	2	float32	R		
Blend stream K - factor	702	02BE	703	40703	2	float32	R		
Inner control win-dow limit	704	02C0	705	40705	2	float32	R	0.01 - 10000.0	10.0
Reserved	706	02C2	707	40707	2				
Middle control window limit	708	02C4	709	40709	2	float32	R	0.01 - 10000	10.0
Reserved	710	02C6	711	40711	2				
Outer control wndow limit	712	02C8	713	40713	2	float32	R	0.01 - 10000.0	100.0
Reserved	714	02CA	715	40715	2				
Calibration high flow rate	716	02CC	717	40717	2	float32	R	1.0 - 9999.0	60.0
Reserved	718	02CE	719	40719	2				
Calibration low flow rate	720	2D0	721	40721	2	float32	R	1.0 - 100.0	15.0
Reserved	722	2D2	723	40723	2				

Parameter Name	Starting Holding Register				Data Size / Type		Access	Range	Default
	Adress (Decimal / Hex)		Number (Std. / Modicon)		Regis-ters	Type			
Leaking blend valve volume limit	724	02D4	725	40725	2	float32	R	1.0 - 9999.0	100.0
Reserved	726	02D6	727	40727	2				
Wild stream clos-ing volume	728	02D8	729	40729	2	float32	R	1.0 - 9999.0	150.0
Reserved	730	02DA	731	40731	2				
Transactional blend percentage	732	02DC	733	40733	2	float32	R		
See section 7.3.2.1 for parameters with holding register 40801 through 40856.									
Solenoid active dwell	900	0384	901	40901	1	uint16	R	50 - 1000	100
Solenoid rest dwell	901	0385	902	40902	1	uint16	R	50 - 1000	100
Reserved	902	0386	903	40903	1				
Permissive func-tion	903	0387	904	40904	1	uint16 (enum)	R	See section 15.2.2.10	
Wild stream pulse timeout	904	0388	905	40905	1	uint16	R	1 - 999	5
Unit address	905	0389	906	40906	1	uint16	R	1 - 997	123
Broadcast address	906	038A	907	40907	1	uint16	R		
Permissive hys-teresis	907	038B	908	40908	1	uint16	R	0 - 1000	250
Calibration inner flow rate control window	908	038C	909	40909	1	uint16	R	1 - 100	10
Calibration outer flow rate control window	909	038D	910	40910	1	uint16	R	1 - 9999	25
VCF status	910	038E	911	40911	1	uint16	R		
Blend stream pulse timeout	1000	03E8	1001	41001	1	uint16	R	1 - 90	2
Deviation count smoothing value	1001	03E9	1002	41002	1	uint16	R	0 - 12	10
Flow calculation smoothing value	1002	03EA	1003	41003	1	uint16	R	1 - 99	10
Control failure alarm timeout	1003	03EB	1004	41004	1	uint16	R	1 - 30	10
Blend stream closing timeout	1004	03EC	1005	41005	1	uint16	R	1 - 240	60

Parameter Name	Starting Holding Register				Data Size / Type		Access	Range	Default
	Adress (Decimal / Hex)		Number (Std. / Modicon)		Regis-ters	Type			
No activity time-out period	1005	03ED	1006	41006	2	uint16	R	1 - 6535	30
Reset blend deviation counter at transaction start	1100	044C	1101	41101	1	uint16 (enum)	R	See section 15.2.2.6	
Factored pulse output resolution 1	1101	044D	1102	41102	1	uint16 (enum)	R	See section 15.2.2.5	
Factored pulse output resolution 2	1102	044E	1103	41103	1	uint16 (enum)	R	See section 15.2.2.5	
Pre-shutdown volume control	1103	044F	1104	41104	1	uint16 (enum)	R	See section 15.2.2.7	
Clean start control	1104	0450	1105	41105	1	uint16 (enum)	R	See section 15.2.2.8	
Blend point relative to wild stream meter	1105	0451	1106	41106	1	uint16 (enum)	R	See section 15.2.2.3	
Control failure alarm action	1106	0452	1107	41107	1	uint16 (enum)	R	See section 15.2.2.2	
Blend percentage alarm action	1107	0453	1108	41108	1	uint16 (enum)	R	See section 15.2.2.2	
Leaking blend valve alarm action	1108	0454	1109	41109	1	uint16 (enum)	R	See section 15.2.2.2	
Wild stream closing volume alarm action	1109	0455	1110	41110	1	uint16 (enum)	R	See section 15.2.2.2	
Blend stream closing timeout aarm action	1110	0456	1111	41111	1	uint16 (enum)	R	See section 15.2.2.2	
Reserved	1111	0457	1112	41112	1				
No activity alarm action	1112	0458	1113	41113	1	uint16 (enum)	R	See section 15.2.2.2	
Flush volume alarm action	1113	0459	1114	41114	1	uint16 (enum)	R	See section 15.2.2.2	

Parameter Name	Starting Holding Register				Data Size / Type		Access	Range	Default
	Adress (Decimal / Hex)		Number (Std. / Modicon)		Regis-ters	Type			
Permissive state	1114	045A	1115	41115	1	uint16 (enum)	R	See section 15.2.2.4	
See section 7.3.2.1 for parameters with holding register 41801 through 41834.									
Task register	2000	07D0	2001	42001	1	uint16 (enum)	W	See section 15.2.2.1	
See section 7.3.2.1 for parameters with holding register 42801 through 42834.									

7.3.2.1 Fusion4 SSC-B Modbus RTU Block

TABLE 7-11 lists the Modbus RTU Protocol parameters with holding register 40801 through 40856, 41801 through 41834, and 42801 through 42834 for the Fusion4 SSC-B (Single Stream Controller for Blending). See CHAPTER 15 for a description of the parameters.

REMARK: In TABLE 7-11, the following scaling factors apply to 32-bit integer type parameters:

Flow rate	* 1000
Percentage	* 100
Temperature	* 100
Other	No scaling

TABLE 7-11 Modbus RTU Protocol Parameters for Fusion4 SSC-B (continued)

Parameter Name	Starting Holding Register				Data Size / Type		Access
	Address (Decimal / Hex)		Number (Std. / Modicon)		Regis-ters	Type	
Blend stream state (See also section 15.2.2.17)	800	0320	801	40801	1	uint16	R
	1800	0708	1801	41801	1	uint16	
	2800	0AF0	2801	42801	1	uint16	
Active alarms (See also section 15.2.2.18)	801	0321	802	40802	1	uint16	R
	1801	0709	1802	41802	1	uint16	
	2801	0AF1	2802	42802	1	uint16	
Accumulative total load stream gross observed volume	802	0322	803	40803	4	float64	R
	1802	070A	1803	41803	2	float32	
	2802	0AF2	2803	42803	2	int32	

Parameter Name	Starting Holding Register				Data Size / Type		Access
	Address (Decimal / Hex)		Number (Std. / Modicon)		Regis-ters	Type	
Accumulative total blend stream gross observed volume	806	0326	807	40807	4	float64	R
	1804	070C	1805	41805	2	float32	
	2804	0AF4	2805	42805	2	int32	
Transactional load stream gross observed volume	810	032A	811	40811	4	float64	R
	1806	070E	1807	41807	2	float32	
	2806	0AF6	2807	42807	2	int32	
Transactional blend stream gross observed volume	814	032E	815	40815	4	float64	R
	1808	0710	1809	41809	2	float32	
	2808	0AF8	2809	42809	2	int32	
Accumulative blend stream gross standard volume	818	0332	819	40819	4	float64	R
	1810	0712	1811	41811	2	float32	
	2810	0AFA	2811	42811	2	int32	
Transactional blend stream gross standard volume	822	0336	823	40823	4	float64	R
	1812	0714	1813	41813	2	float32	
	2812	0AFC	2813	42813	2	int32	
Product stream flow rate	826	033A	827	40827	4	float64	R
	1814	0716	1815	41815	2	float32	
	2814	0AFE	2815	42815	2	int32	
Blend stream flow rate	830	033E	831	40831	4	float64	R
	1816	0718	1817	41817	2	float32	
	2816	0B00	2817	42817	2	int32	
Transactional blend percentage	834	0342	835	40835	4	float64	R
	1818	071A	1819	41819	2	float32	
	2818	0B02	2819	42819	2	int32	
Blend stream temperature	838	0346	839	40839	4	float64	R
	1820	071C	1821	41821	2	float32	
	2820	0B04	2821	42821	2	int32	
Blend stream pressure	842	034A	843	40843	4	float64	R
	1822	071E	1823	41823	2	float32	
	2822	0B06	2823	42823	2	int32	
Software version	846	034E	847	40847	4	char(8)	R
	1824	0720	1825	41825	4	char(8)	
	2824	0B08	2825	42825	4	char(8)	

Parameter Name	Starting Holding Register Address (Decimal / Hex)		Number (Std. / Modicon)		Data Size / Type Regis-ters	Type	Access
Product ID	850	0352	851	40851	5	char(10)	R
	1828	0724	1829	41829	5	char(10)	
	2828	0B0C	2829	42829	5	char(10)	
Device serial number	855	0357	856	40856	4	char(8)	R
	1833	0729	1834	41834	4	char(8)	
	2833	0B11	2834	42834	4	char(8)	

7.3.3 Fusion4 MSC-A

TABLE 7-12 lists the Modbus RTU Protocol parameters for the Fusion4 MSC-A (Multi-Stream Controller for Additive Injection). See section 15.1 for a description of the parameters.

TABLE 7-12 Modbus RTU | TCP/IP Protocol Parameters for Fusion4 MSC-A

Parameter Name	Starting Holding Register Address (Decimal / Hex)		Number (Std. / Modicon)		Data Size/Type Regis-ters	Type	Access	Range	Default
Accumulative total additive stream gross observed volume	000	0000	001	40001	4	float64	R		
Accumulative transactional additive stream gross observed volume	004	0004	005	40005	4	float64	R		
Accumulative leaking solenoid gross observed volume	008	0008	009	40009	4	float64	R		
Accumulative cali-bration gross observed volume	012	000C	013	40013	4	float64	R		
Accumulative wild stream gross observed volume	016	0010	017	40017	4	float64	R		
Wild stream K-factor	100	0064	101	40101	2	float32	R/W		100.0
Additive K-factor	102	0066	103	40103	2	float32	R/W		750.0

Parameter Name	Starting Holding Register				Data Size/Type		Access	Range	Default
	Address (Decimal / Hex)		Number (Std. / Modicon)		Regis-ters	Type			
Leaking solenoid volume limit	104	0068	105	40105	2	float32	R/W	0.0 - 999.9	0.1
Solenoid dwell time	200	00C8	201	40201	1	uint16	R/W	0 - 32767	0
Factored pulse output resolution	201	00C9	202	40202	1	uint16 (enum)	R/W	See section 15.2.1.5	2
Pacing source	202	00CA	203	40203	1	uint16 (enum)	R/W	See section 15.2.1.4	
Unit address	203	00CB	204	40204	1	uint16	R	1 - 997	123
Reserved	204	00CC	205	40205	1				
Reserved	205	00CD	206	40206	1				
Feedback pulse duration	206	00CE	207	40207	1	uint16	R/W	0 - 1000	500
Slow flow volume alarm action	207	00CF	208	40208	1	uint16 (enum)	R/W	See section 15.2.1.2	
No additive alarm action	208	00D0	209	40209	1	uint16 (enum)	R/W	See section 15.2.1.2	
Additive volume deviation alarm action	209	00D1	210	40210	1	uint16 (enum)	R/W	See section 15.2.1.2	
Leaking solenoid alarm action	210	00D2	211	40211	1	uint16 (enum)	R/W	See section 15.2.1.2	
No activity time-out alarm action	211	00D3	212	40212	1	uint16 (enum)	R/W	See section 15.2.1.2	
Permissive state	212	00D4	213	40213	1	uint16 (enum)	R	See section 15.2.1.3	
Solenoid close delay	213	00D5	214	40214	1	uint16	R/W	500 - 10000	500
Active alarms	214	00D6	215	40215	1	uint16	R		
Permissive func-tion	215	00D7	216	40216	1	uint16 (enum)	R/W	See section 15.2.1.6	
Alarm and per-missive state (injectors 1 - 6)*	216	00D8	217	40217	1	uint16 (bits)	R		

Parameter Name	Starting Holding Register Address (Decimal / Hex)		Starting Holding Register Number (Std. / Modicon)		Data Size/Type Regis-ters	Data Size/Type Type	Access	Range	Default
Alarm and permissive state (injectors 7 - 12)*	217	00D9	218	40218	1	uint16 (bits)	R		
Additive deviation basis	300	012C	301	40301	1	uint16	R/W		
Number of solenoid retries	301	012D	302	40302	1	uint16	R/W	0 - 2	2
No additive flow timeout period	302	012E	303	40303	1	uint16	R/W	1 - 9	2
Leaking solenoid timeout period	303	012F	304	40304	1	uint16	R/W	1 - 99	60
No activity timeout period	304	0130	305	40305	1	uint16	R/W	1 - 65535	60
Injection volume	400	0190	401	40401	2	float32	R/W	0.10 - 9900.00	20,00
Volume per injection cycle	402	0192	403	40403	2	float32	R/W	0.001 - 9999.9	40,00
Minimum product volume for transaction	404	0194	405	40405	2	float32	R/W	1.00 - 999.00	10,00
Clean start gross observed volume	406	0196	407	40407	2	float32	R/W	0.00 - 999.00	0,00
High flow threshold value	408	0198	409	40409	2	float32	R/W	0.0 - 30000.0	1000.0
Low flow threshold value	410	019A	411	40411	2	float32	R/W	0.0 - 30000.0	1000.0
Number of clean start cycles	600	0258	601	40601	1	uint16	R/W	1 - 99	10
Injection offset	601	0259	602	40602	1	uint16	R/W	0 - 100	0
Pump run timeout	602	025A	603	40603	1	uint16	R/W	1 - 255	10
Additive volume deviation allowed	603	025B	604	40604	1	uint16	R/W	1 - 100	10
Transaction closing time	604	025C	605	40605	1	uint16	R/W	5 - 255	30
See section 7.3.3.1 for parameters with holding register 40801 through 41826.									
Task register	2000	07D0	2001	42001	1	uint16 (enum)	W/R	See section 15.2.1.1	
See section 7.3.3.1 for parameters with holding register 42801 through 42826.									

REMARK: The * (asterix) denotes global parameters affecting ALL injector channels.

7.3.3.1 Fusion4 MSC-A Modbus RTU | TCP/IP Block

TABLE 7-13 lists the Modbus RTU | TCP/IP Protocol parameters with holding register 40801 through 40840, 41801 through 41826, and 42801 through 42826 for the Fusion4 MSC-A (Multi-Stream Controller for Additive Injection). See section 15.1 for a description of the parameters.

REMARK: In TABLE 7-13, the following scaling factors apply to 32-bit integer type parameters:

Flow rate	* 1000
Percentage	* 100
Temperature	* 100
Other	No scaling

TABLE 7-13 Modbus RTU | TCP/IP Protocol Parameters for Fusion4 MSC-A (continued)

Parameter Name	Starting Holding Register				Data Size / Type		Access
	Address (Decimal / Hex)		Number (Std. / Modicon)		Regis-ters	Type	
Additive stream state (See also section 15.2.1.7)	800	0320	801	40801	1	uint16	R
	1800	0708	1801	41801	1	uint16	
	2800	0AF0	2801	42801	1	uint16	
Active alarms (See also section 15.2.1.8)	801	0321	802	40802	1	uint16	R
	1801	0709	1802	41802	1	uint16	
	2801	0AF1	2802	42802	1	uint16	
Accumulative total load stream gross observed volume	802	0322	803	40803	4	float64	R
	1802	070A	1803	41803	2	float32	
	2802	0AF2	2803	42803	2	int32	
Accumulative total additive stream gross observed volume	806	0326	807	40807	4	float64	R
	1804	070C	1805	41805	2	float32	
	2804	0AF4	2805	42805	2	int32	
Transactional load stream gross observed volume	810	032A	811	40811	4	float64	R
	1806	070E	1807	41807	2	float32	
	2806	0AF6	2807	42807	2	int32	
Transactional additive stream gross observed volume	814	032E	815	40815	4	float64	R
	1808	0710	1809	41809	2	float32	
	2808	0AF8	2809	42809	2	int32	

Parameter Name	Starting Holding Register				Data Size / Type		Access
	Address (Decimal / Hex)		Number (Std. / Modicon)		Regis-ters	Type	
Product stream flow rate	818	0332	819	40819	4	float64	R
	1810	0712	1811	41811	2	float32	
	2810	0AFA	2811	42811	2	int32	
Additive stream flow rate	822	0336	823	40823	4	float64	R
	1812	0714	1813	41813	2	float32	
	2812	0AFC	2813	42813	2	int32	
Transaction PPM	826	033A	827	40827	4	float64	R
	1814	0716	1815	41815	2	float32	
	2814	0AFE	2815	42815	2	int32	
Software version*	830	033E	831	40831	4	char[8]	R
	1816	0718	1817	41817	4	char[8]	
	2816	0B00	2817	42817	4	char[8]	
Product ID*	834	0342	835	40835	5	char[10]	R
	1820	071C	1821	41821	5	char[10]	
	2820	0B04	2821	42821	5	char[10]	
Device serial number*	839	0347	840	40840	4	char[8]	R
	1825	0721	1826	41826	4	char[8]	
	2825	0B09	2826	42826	4	char[8]	

REMARK: The ***** (asterix) denotes global parameters affecting ALL injector channels.

7.3.4 Fusion4 MSC-L

=> Future implementation

CHAPTER 8 SERIAL LINE INTERNET PROTOCOLS (SLIP+)

8.1 Description

SLIP+ is an Internet Protocol designed to work on an RS422/485 interface using a baudrate of 150 to 9600 bps, any parity and 8 data bits.

All data is sent in 8-bit binary data in the general format shown below:

C0H	ADDR	CONTROL	INFORMATION	LRC	C0H

Term	Description
C0H	Each frame is preceded and followed by a special frame end (FEND) character, C0H. The reason for both preceding and ending frames with FENDS is to improve performance when there is noise on the asynchronous line. The maximum number of bytes per frame is 200.
ADDR	Address byte, see section 8.1.1.
CONTROL	Control byte, see section 8.1.2.
INFORMATION	Information field, see section 8.1.3.
LRC	Longitudinal Redundancy Checksum byte, see section 8.1.4.

8.1.1 Address Byte

When information is sent from the host computer to an instrument, the address byte should contain the designation address of the instrument for which the information is intended.

When information is sent from an instrument to a host computer, the Address byte should contain the address of the instrument from which the information is being sent.

The address of the instrument is the identification number (ID) with 80H added to it, where the address is in the range of 80H to 9FH. For example, an instrument ID = 2 would be transmitted as an address of 82H.

8.1.2 Control Byte

The Control byte should be one of the following:

Control Byte	HEX Value	Description
ENQ	05	Used by the host computer to poll the instruments.
STX	02	Used to indicate that the information field contains data.
ACK	06	Used by the instrument to indicate that the frame was correctly received.

Control Byte	HEX Value	Description
NAK	15	Used by the instrument to indicate that the search for a given transaction number was unsuccessful.
EOT	04	Used by the host computer to indicate the end of transmission.

8.1.3 Information Field

The information field is an optional field and is only present when the STX control byte is used. It should be terminated by ETX (03H) to indicate the end of the information field, or ETB (17H) to indicate the end of the information field, but that there is more information to follow in the next frame.

The information itself should be in the ASCII range of values 20H through to 7FH.

The information field should contain a two-byte alphanumeric command and an arbitrary number of data fields. Each of these fields should be terminated by a NULL (0).

The information field should be in the general format shown below:

COMMAND	0	****	0	*****	0	*****	****	0	ETX

8.1.4 Longitudinal Redundancy Checksum Byte

The Longitudinal Redundancy Checksum (LRC) byte should be equal to the Exclusive OR (XOR) of all the bytes in the packet, excluding the (C0H) brackets. The LRC register should be set to 0 at the beginning of each frame.

The LRC should be derived by the transmitting unit during transmission and then sent to the receiving unit. The receiving unit should, in turn, check each byte for parity, derive the LRC from the information it has received and then compare the LRC it received to the one it derived.

Once the correct closing bracket has been received, one of the following conditions would arise:

Receiving Unit	Frame Correct	Frame Incorrect
Host computer	Send next command or EOT	Repeat command
Instrument	Send data, if command calls for data to be sent. If else, send ACK.	Do nothing.

The following conditions should be met in order for a frame to be acceptable:

- All bytes (including the frame bracketing bytes) should pass the parity check.
- The address byte should match the Unit's address.
- The derived LRC should match the one received.
- A valid end of frame bracket should be received within 200 ms after the opening bracket.

8.1.5 General Procedure of Communications

1. The host computer (Master) polls the instrument by sending it an ENQ frame.
2. The Instrument replies with the appropriate data.
3. Depending on the status of the instrument, the Master could continue to communicate with the instrument by sending it another command, or end the session by sending an EOT frame, waiting for the corresponding ACK from the Instrument and then going on to the next instrument. No other operations should take place on the Instrument until the EOT command has been received.

REMARK: All consecutive commands from the Master should follow one another within 100 ms after the reply or ACK frame from the instrument.

8.2 Fusion4 MSC-A

To provide backward compatibility, the Fusion4 MSC-A (Multi-Stream Controller for Additive Injection) uses the Serial Line Internet Protocol (SLIP+) to replace the Model 1020 Additive Injection System.

8.2.1 Commands

The SLIP+ commands are two-character codes. Some commands also require numeric parameter(s). If the command requests data from the device then the data is returned, prefaced by the command echo. Otherwise, the device responds with ACK. The device returns NAK if the command is not recognized.

8.2.1.1 Query Commands

TABLE 8-1 lists the SLIP+ protocol query commands.

TABLE 8-1 SLIP+ Protocol Query Commands

Command	Description
AD n	Displays the delivery additive for line n.

Command	Description
PD n	Displays the delivery product for line n.
AR n	Displays the additive rate for line n.
DA	Displays the batch totals on all lines.
DB	Displays the accumulated additive totals on all lines.
DC	Displays the accumulated product totals on all lines.
DD	Displays the date and time.
EC	Displays the number of cycles.
ER	Displays the percentage error for Low Alarm 2.
ET	Display the event timeout.
FS	Displays whether Flow Switch is armed on each line
KA	Displays the K-factors for the additive flow meters on all lines.
KP	Displays the K-factors for the product flow meters on all lines.
PA	Displays the batch preset in cc's or ml's on all lines.
PB	Displays the product preset on all lines.
PI	Displays wether Permissive Inputs are armed on each line.
TR	Displays whether Transaction Space is remaining on each line.
VA	Displays all alarms occurring during a transaction. The VA command is similar to VH command, except that these alarm variables are reset by the RH command.
VH	Displays all alarms occurring during a transaction. These alarms are only reset at the beginning of a new delivery.
VR	Displays the software version.
AL	Displays whether Alarm Low Flow is armed on each line.

8.2.1.2 Commands for Changing Values

TABLE 8-2 lists the SLIP+ protocol commands for changing values.

REMARK: With the commands listed in TABLE 8-2, the first number is the line number and is designated "c".

TABLE 8-2 SLIP+ Protocol Commands for Changing Values

Command	Description
RAc xxxx.x	Presets the batch total on line c.
RBc xxxxxx.xx	Presets the additive total.
RCc xxxxxxxx	Presets the product total.
KAc xxxxx.xx	Sets the K-factor for the additive flow meter.
KPc xxxxx.xx	Sets the K-factor for the product flow meter.

Command	Description
PAc xxxx.x	Sets the batch preset.
PBc xxxx	Sets the product preset.
TE or TD	Enables or Disables the Start key.
TA or TN	Adds or Does not add totals.
RHc	Resets all alarms on line c.
AYc or ANc	Arms or Disarms Alarm Low Flow 1.
KE or KD	Enables or Disables keyboard entry.
SD xxxxxx	Sets the date (Month, Day, Year).
ERcxx	Sets the percentage error for Low Alarm 2 on line c.
ECcxxxx	Sets the number of cycles for Low Alarm 2 on line c.
ETxxxx	Sets the event timeout (in seconds).
PYc	Arms permissives.
PNc	Disarms permissives.
FYc	Arms flow switches.
FNc	Disarms flow switches.
BYc	Arms Low Flow 2.
BNc	Disarms Low Flow 2.
CD n	Clears last delivery and product totals for line n.
MO n	Selects Mode 1 or Mode 2 operation.
PS n	Starts pump n.
PX n	Stops pump n. (n = 0 stops all pumps.)
PT n	Enables line n software permissive (TRUE).
PF n	Disables line n software permissive (FALSE).
GOc	Starts an injection pulse (ie. start a batch) on line c.

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CHAPTER 9 FLEXCONN PROTOCOL

FlexConn is a Honeywell Enraf proprietary protocol for exchange of full device data, configuration, diagnostics and command set to be used to communicate between Fusion4 Portal and Fusion4 controllers (Fusion4 SSC, Fusion4 MSC) and between MSC-L and slave controllers (Fusion4 SSC-A, Fusion4 SSC-B, Fusion4 MSC-A). The FlexConn protocol is implemented on both RS-485 and Ethernet communication channels.

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CHAPTER 10 RS-485 WIRING FOR FUSION4 SSC-A/SSC-B

10.1 Introduction

The Fusion4 SSC-A (Single Stream Controller for Additive Injection) and the Fusion4 SSC-B (Single Stream Controller for Blending) both feature RS-485 terminal connectors to allow the controllers to communicate with external devices via an RS-422/485 compliant connection.

The following connections are supported or will be supported in the future:

- Serial connection between Fusion4 SSC-A/SSC-B and Fusion4 MSC-L (Multi-Stream Controller for Loading), see section 10.3
- Serial connection between Fusion4 SSC-A/SSC-B and 1010 B-series load computer, see section 10.4
- Serial connection between Fusion4 SSC-A/SSC-B and 1010 C-series load computer, see section 10.5
- Serial connection between Fusion4 SSC-A/SSC-B and a PC running Fusion4 Portal, see section 10.6
- Serial connection between Fusion4 SSC-A/SSC-B and a PC running Experion®, see section 10.7

10.2 Fusion4 SSC-A and SSC-B Serial Connectivity

The Fusion4 SSC-A and the Fusion4 SSC-B each house two boards with an RS-422/485 terminal connector to connect the SSC-A/SSC-B to external devices:

- CAN-ADD-BLEND board, see section 10.2.1
- CAN-OPTION-SSC board, see section 10.2.2

10.2.1 CAN-ADD-BLEND Board

The CAN-ADD-BLEND board has an RS-422/485 terminal connector (CN6) that can be used to connect the SSC-A/SSC-B to an external device.

Connector CN6 can be used to establish the following connections:

- 2-Wire half-duplex RS-485 connection between Fusion4 SSC-A/ SSC-B and external device, see section 10.2.1.1. This type of connection is typically used to connect the Fusion4 SSC-A/SSC-B to a Fusion4 MSC-L or to a 1010 B-series or C-series load computer.
- 4-Wire full-duplex RS-485 connection between Fusion4 SSC-A/ SSC-B and external device, see section 10.2.1.2. This type of connection is typically used to connect the SSC-A/SSC-B to a Fusion4 MSC-L.

- 4-Wire full-duplex RS-422 connection between Fusion4 SSC-A/SSC-B and external device, see section 10.2.1.3. This type of connection is typically used to connect the SSC-A/SSC-B to a 1010 B-series or C-series load computer.

NOTE: *See also the Installation & Operation Manual Fusion4 SSC-A and the Installation & Operation Manual Fusion4 SSC-B for more information.*

10.2.1.1 2- Wire Half-Duplex RS-485 Connection

A 2-wire half-duplex RS-485 connection is typically used to connect the Fusion4 SSC-A/SSC-B to a Fusion4 MSC-L or to a 1010 B-series or C-series load computer.

REMARK: When connecting the Fusion4 SSC-A/SSC-B, terminal connector CN6 must be configured for 2-wire half-duplex communication using the RS COMM mode switch on the CAN-ADD-BLEND board.

FIGURE 10-1 schematically shows a 2-wire half-duplex RS-485 connection between the Fusion4 SSC-A/SSC-B and an external device.

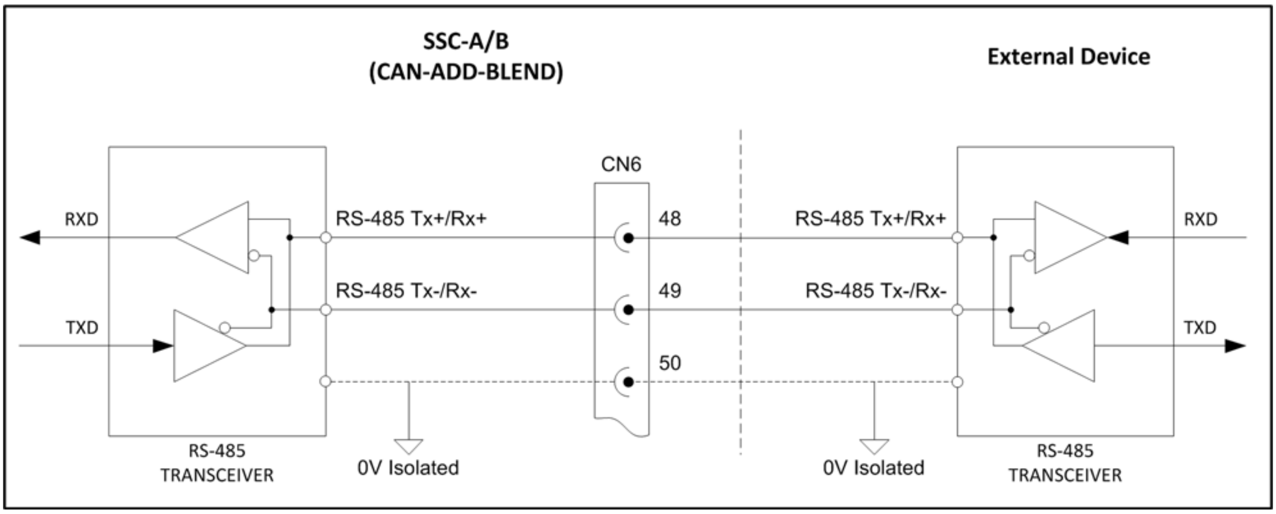

FIGURE 10-1 2-Wire Half-Duplex RS-485 Connection between Fusion4 SSC-A/SSC-B and External Device (CAN-ADD-BLEND Board)

TABLE 10-1 describes the layout of terminal connector CN6 in a 2-wire half-duplex RS-485 connection.

TABLE 10-1 Layout of Terminal Connector CN6 in 2-Wire Half-Duplex RS-485 Connection

Connector ID	Connector Pin	Signal Name	Signal Description
CN6	48	RS485_A	2W RS-485 Tx+/Rx+
	49	RS485_B	2W RS-485 Tx-/Rx-
	50	RS485_0V	0 Volt

10.2.1.2 4-Wire Full-Duplex RS-485 Connection

A 4-wire full-duplex RS-485 connection is typically used to connect the Fusion4 SSC-A/SSC-B to a Fusion4 MSC-L.

REMARKS:

1. When connecting the Fusion4 SSC-A/SSC-B, terminal connector CN6 must be configured for 4-wire full-duplex communication using the RS COMM mode switch on the CAN-ADD-BLEND board.
2. In a 4-wire full-duplex connection, the external device is always the master and the Fusion4 SSC-A/SSC-B is the slave.

FIGURE 10-2 schematically shows a 4-wire full-duplex RS-485 connection between an Fusion4 SSC-A/SSC-B and an external device.

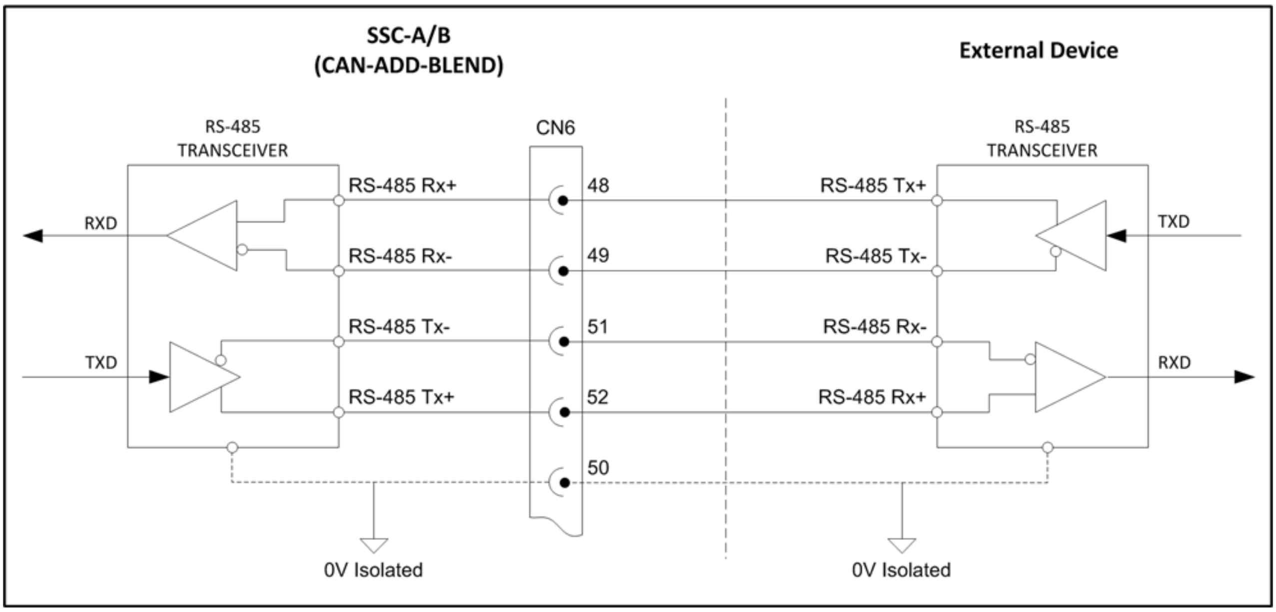

FIGURE 10-2 4-Wire Full-Duplex RS-485 Connection between Fusion4 SSC-A/B and External Device (CAN-ADD-BLEND Board)

TABLE 10-2 describes the layout of terminal connector CN6 in a 4-wire full-duplex RS-485 connection.

TABLE 10-2 Layout of Terminal Connector CN6 in RS-485 4-Wire Full-Duplex Connection

Connector		Signal Name	Signal Description
ID	Pin		
CN6	48	RS485_A	RS-485 4W Rx+
	49	RS485_B	RS-485 4W Rx-
	50	RS485_0V	0 Volt
	51	RS485_Z	RS-485 4W Tx-
	52	RS485_Y	RS-485 4W Tx+

10.2.1.3 4-Wire Full-Duplex RS-422 Connection

A 4-wire full-duplex RS-422 connection is typically used to connect an Fusion4 SSC-A/SSC-B to a 1010 B-series or C-series load computer.

REMARKS:

1. When connecting the Fusion4 SSC-A/SSC-B, terminal connector CN6 must be configured for 4-wire full-duplex communication using the RS COMM mode switch on the CAN-ADD-BLEND board.
2. In a 4-wire full-duplex connection, the external device is always the master and the Fusion4 SSC-A/SSC-B is the slave.

FIGURE 10-3 schematically shows a 4-wire full-duplex RS-422 connection between an Fusion4 SSC-A/SSC-B and an external device.

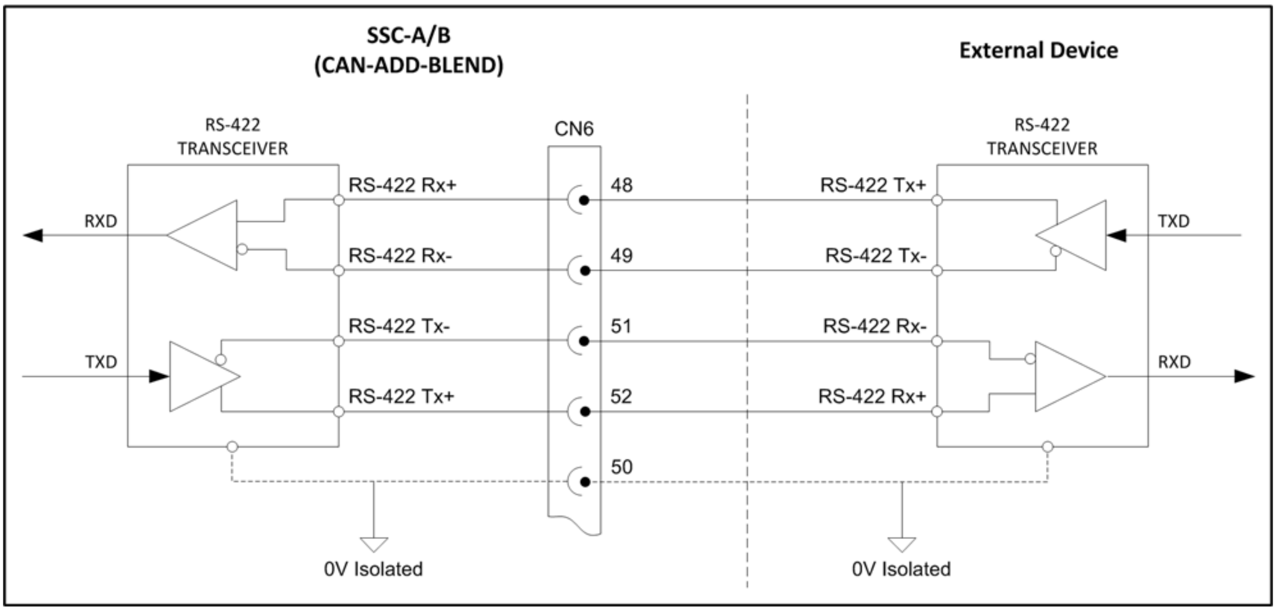

FIGURE 10-3 4-Wire Full-Duplex RS-422 Connection between Fusion4 SSC-A/B and External Device (CAN-ADD-BLEND Board)

TABLE 10-3 describes the layout of terminal connector CN6 in a 4-wire full-duplex RS-422 connection.

TABLE 10-3 Layout of Terminal Connector CN6 in 4-Wire Full-Duplex RS-422 Connection

Connector ID	Connector Pin	Signal Name	Signal Description
CN6	48	Data In (+)	4W RS-422 Rx+
	49	Data In (-)	4W RS-422 Rx-
	50	GROUND	0 Volt
	51	Data Out (-)	4W RS-422 Tx-
	52	Data Out (+)	4W RS-422 Tx+

10.2.2 CAN-OPTION-SSC Board

The CAN-OPTION-SSC board features an RS-485 terminal connecter (CN7) enabling a 2-wire half-duplex RS-485 connection between the SSC-A/SSC-B and an external device. This connector is preferably used to connect the Fusion4 SSC-A/SSC-B to a PC running for example Fusion4 Portal.

FIGURE 10-4 schematically shows a 2-wire half-duplex RS-485 connection between an Fusion4 SSC-A/SSC-B and an external device.

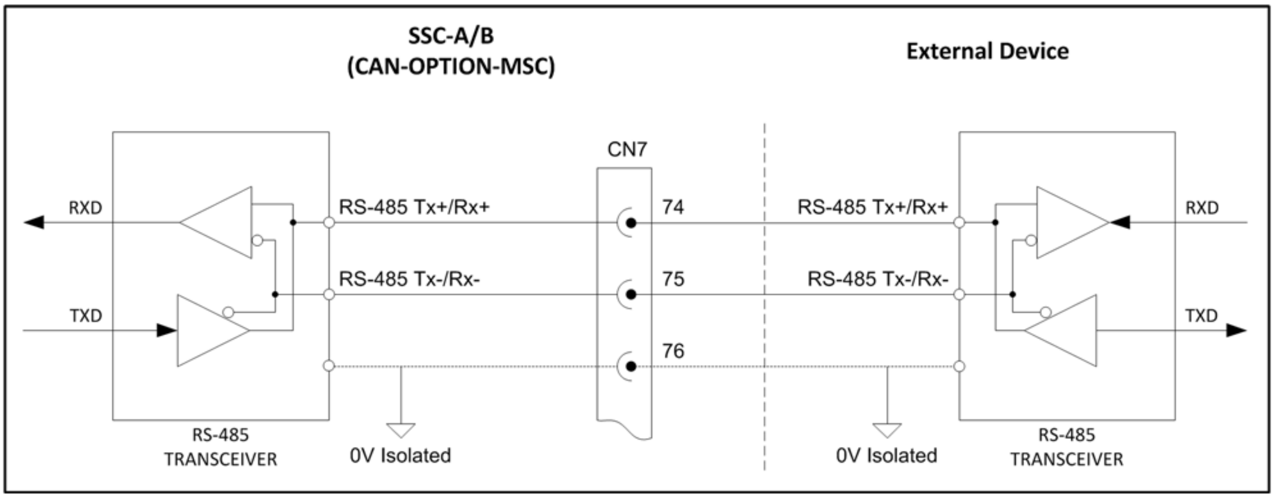

FIGURE 10-4 2-Wire Half-Duplex RS-485 Connection between Fusion4 SSC-A/SSC-B and External Device (CAN-OPTION-SSC Board)

TABLE 10-4 describes the layout of terminal connector CN7.

TABLE 10-4 Layout of Terminal Connector CN7 in 2-wire half-duplex RS-485 connection

Connector		Signal Name	Signal Description
ID	Pin		
CN7	74	RS485_A	2W RS-485 Tx+/Rx+
	75	RS485_B	2W RS-485 Tx-/Rx-
	76	RS485_0V	0 Volt

10.3 Connecting Fusion4 SSC-A/SSC-B to MSC-L

=> Future implementation

10.4 Connecting Fusion4 SSC-A/SSC-B to 1010 B-Series

The Fusion4 SSC-A/SSC-B can be connected to a 1010 B-series load computer via a 2-wire half-duplex RS-485 serial connection. The following terminal connectors/COM ports must be used:

- Fusion4 SSC-A/SSC-B: terminal connector CN6
- 1010 B-series: MAIN port

REMARKS:

1. When connecting the Fusion4 SSC-A/SSC-B, terminal connector CN6 must be configured for 2-wire RS-485 communication using the RS COMM mode switch SW2 on the CAN-ADD-BLEND board.
2. If the connection to the Fusion4 SSC-A/SSC-B represents the last link in a multi-drop bus, then the bus must be terminated by setting jumper JP8 on the CAN-ADD-BLEND board to the right-hand (terminated) position. The serial bus will be terminated with a 120 Ω resistor.
3. When connecting the 1010 B-series load computer, the MAIN port must be set up for 2-wire RS-485 communication through modifying parameters by using the 1010 keyboard and HMI.

FIGURE 10-5 schematically shows a 2-wire half-duplex RS-485 connection between the Fusion4 SSC-A/B and the 1010 B-series load computer.

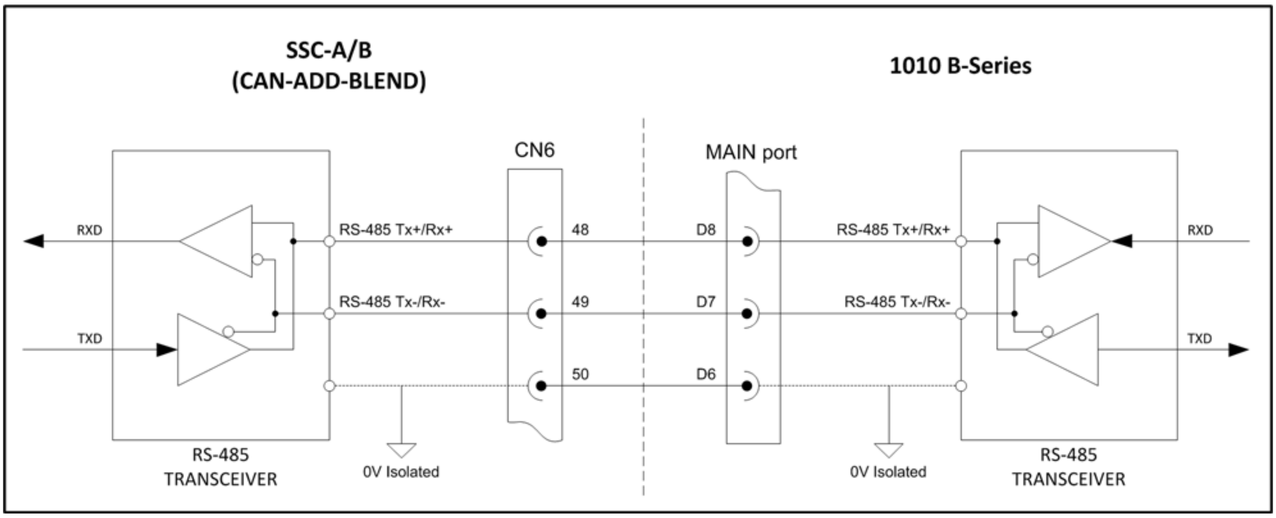

FIGURE 10-5 2-Wire Half-Duplex RS-485 Connection between Fusion4 SSC-A/B and 1010 B-Series

TABLE 10-5 describes the layout of the 1010 B-series MAIN port.

TABLE 10-5 Layout of 1010 B-series MAIN Port

Connector		Signal Name	Signal Description
ID	**Pin**		
MAIN port	D6	RS485_0V	0 Volt
	D7	RS485_A	2W RS-485 Tx-/Rx-
	D8	RS485_B	2W RS-485 Tx+/Rx+

NOTE: *See also Model 1010A Application Pack BJ Wiring Diagrams and Programming Manual for more information.*

10.5 Connecting Fusion4 SSC-A/SSC-B to 1010 C-Series

The Fusion4 SSC-A/SSC-B can be connected to a 1010 C-series load computer via a 2-wire half-duplex RS-485 serial connection. The following terminal connectors/COM ports must be used:

- Fusion4 SSC-A/SSC-B: terminal connector CN6
- 1010 C-series: Port 2 or Port 3

REMARKS:

1. When connecting the Fusion4 SSC-A/SSC-B, terminal connector CN6 must be configured for 2-wire RS-485 communication using the RS COMM mode switch SW2 on the CAN-ADD-BLEND board.
2. If the connection to the Fusion4 SSC-A/SSC-B represents the last link in a multi-drop bus, then the bus must be terminated by setting jumper JP8 on the CAN-ADD-BLEND board to the right-hand (terminated) position. The serial bus will be terminated with a 120 Ω resistor.
3. When connecting the 1010 C-series load computer, the Port 2 / Port 3 must be set up for 2-wire RS-485 communication through modifying parameters by using the 1010 keyboard and HMI.

FIGURE 10-6 schematically shows a 2-wire half-duplex RS-485 connection between the Fusion4 SSC-A/B and the 1010 C-series load computer.

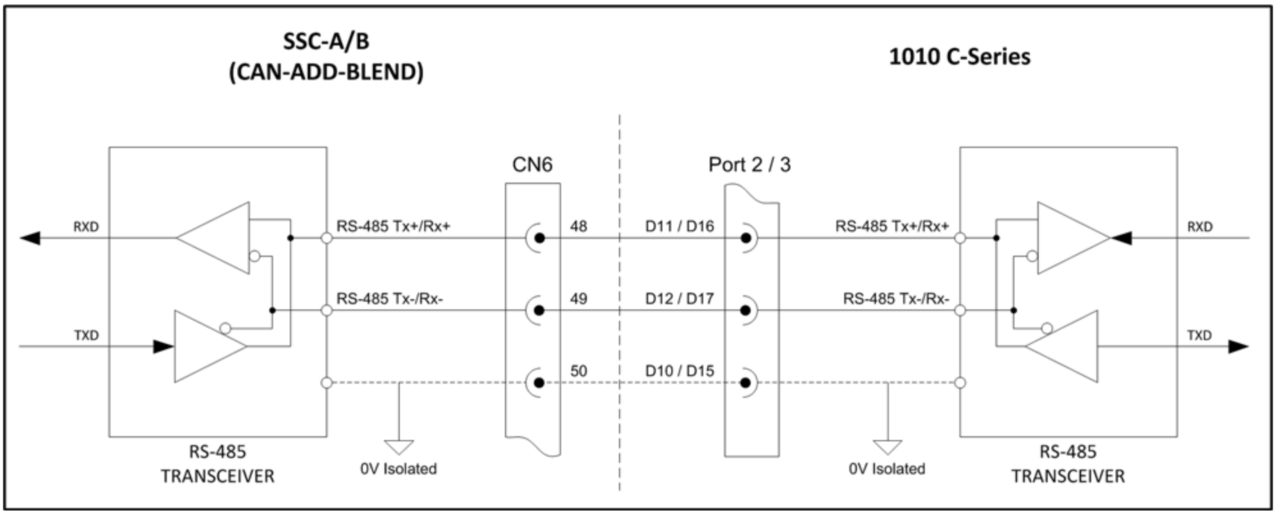

FIGURE 10-6 2-Wire Half-Duplex RS-485 Connection between Fusion4 SSC-A/B and 1010 C-series

TABLE 10-6 describes the layout of 1010 C-series Port 2 and Port 3.

TABLE 10-6 Layout of 1010 C-Series Port 2 and Port 3

Connector		Signal Name	Signal Description
ID	Pin		
PORT 2	D10	RS485_0V	0 Volt
	D11	RS485_A	2W RS 485 Tx+/Rx+
	D12	RS485_B	2W RS 485 Tx-/Rx-
PORT 3	D15	RS485_0V	0 Volt
	D16	RS485_A	2W RS 485 Tx+/Rx+
	D17	RS485_B	2W RS 485 Tx-/Rx-

NOTE: *See also the Card Descriptions and Wiring Manual Load Computer 1010 CB for more information.*

10.6 Connecting Fusion4 SSC-A/SSC-B to Portal

There are a number of ways to connect the Fusion4 SSC-A/SSC-B to a PC running Fusion4 Portal, depending on the connectivity options of the PC:

- A serial connection between the Fusion4 SSC-A/SSC-B and the PC running Fusion4 Portal using an RS-232 to RS-422/485 converter, see section 10.6.1
- A 2-wire half-duplex RS-485 connection between the Fusion4 SSC-A/SSC-B and the PC running Fusion4 Portal, see section 10.6.2
- A serial to Ethernet connection between the Fusion4 SSC-A/SSC-B and the PC running Fusion4 Portal using a serial device server, see section 10.6.3

REMARK: If the connection to the Fusion4 SSC-A/SSC-B represents the last link in a multi-drop bus, then the bus must be terminated by setting jumper JP8 on the CAN-ADD-BLEND board to the right-hand (terminated) position. The serial bus will be terminated with a 120 Ω resistor.

NOTE: See also the Installation & Operation Manual Fusion4 Portal for more information.

10.6.1 RS-232 to RS-422/485 Converter

For the Fusion4 SSC-A/SSC-B to be connected to an RS-232 serial port on the PC running Fusion4 Portal, an RS-232 to RS-422/485 converter is required.

FIGURE 10-7 schematically shows a serial connection between the Fusion4 SSC-A/SSC-B and the PC running Fusion4 Portal, in which an RS-232 to RS-422/485 converter (e.g. Advantech Adam 4520) is used.

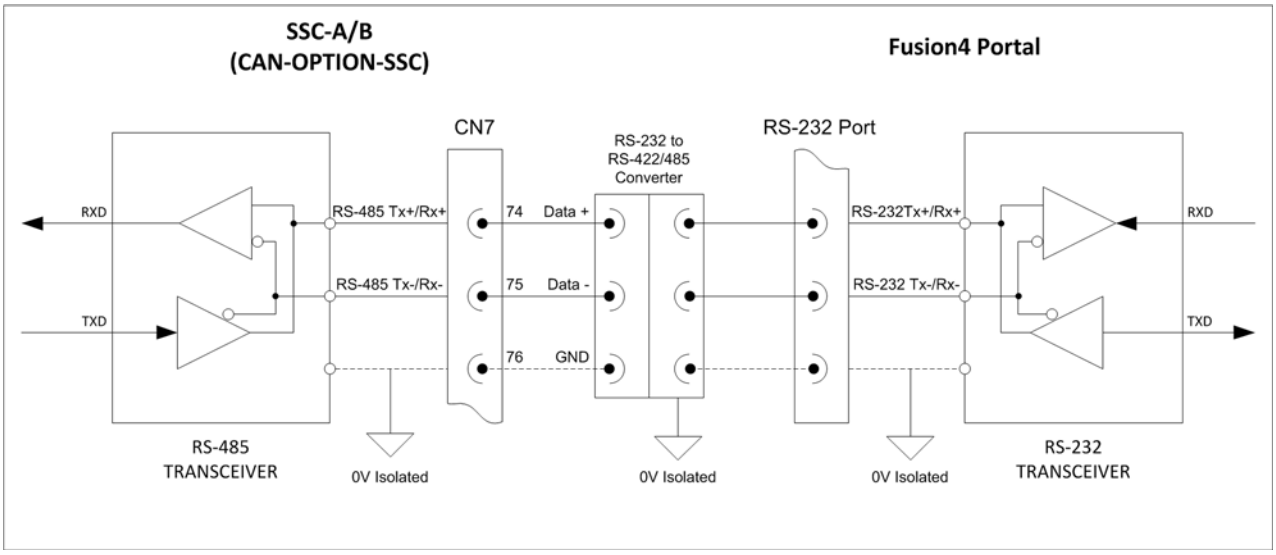

FIGURE 10-7 Connection between Fusion4 SSC-A/SSC-B and Fusion4 Portal using RS-232 to RS-422/485 Converter

10.6.2 RS-485 Serial Connection

For the Fusion4 SSC-A/SSC-B to be connected directly to the PC running Fusion4 Portal, the PC must have an RS-485 serial port.

FIGURE 10-8 schematically shows a 2-wire half-duplex RS-485 connection between the Fusion4 SSC-A/SSC-B and the PC running Fusion4 Portal.

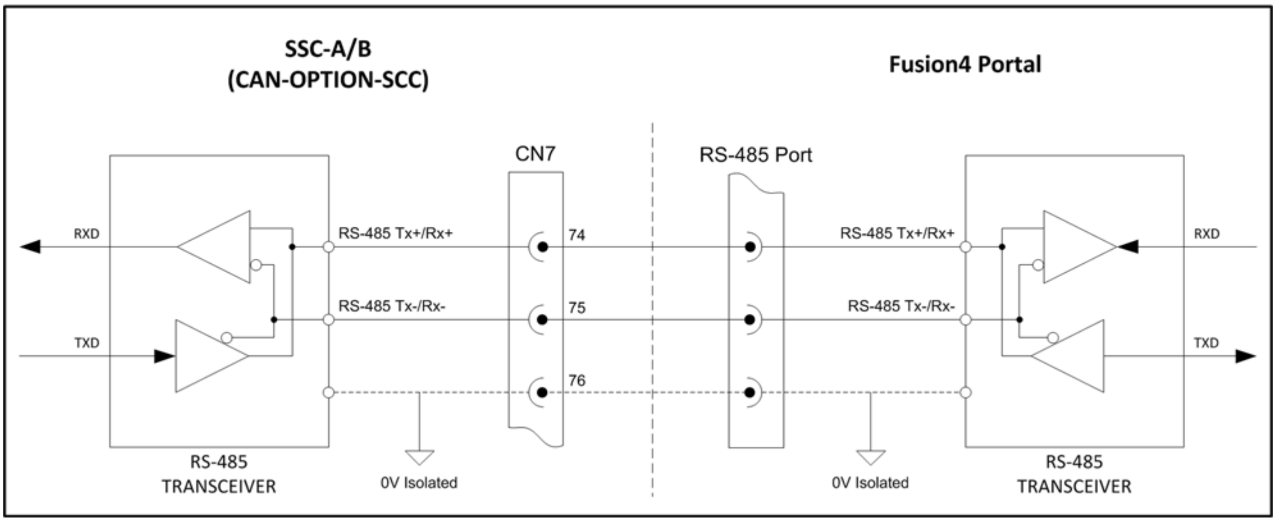

FIGURE 10-8 2-Wire Half-Duplex RS-485 Connection between Fusion4 SSC-A/SSC-B and Fusion4 Portal

10.6.3 Serial Device Server

For the Fusion4 SSC-A to be connected to an Ethernet port of the PC running Fusion4 Portal, a serial device server is required. The serial device server must support RS-422/485.

REMARK: Fusion4 Portal supports the serial device driver through Virtual COM and not through the TCP connection.

FIGURE 10-9 schematically shows a serial to Ethernet connection between the Fusion4 SSC-A/SSCB and the PC running Fusion4 Portal, in which a serial device server (e.g. Moxa NPort) is used.

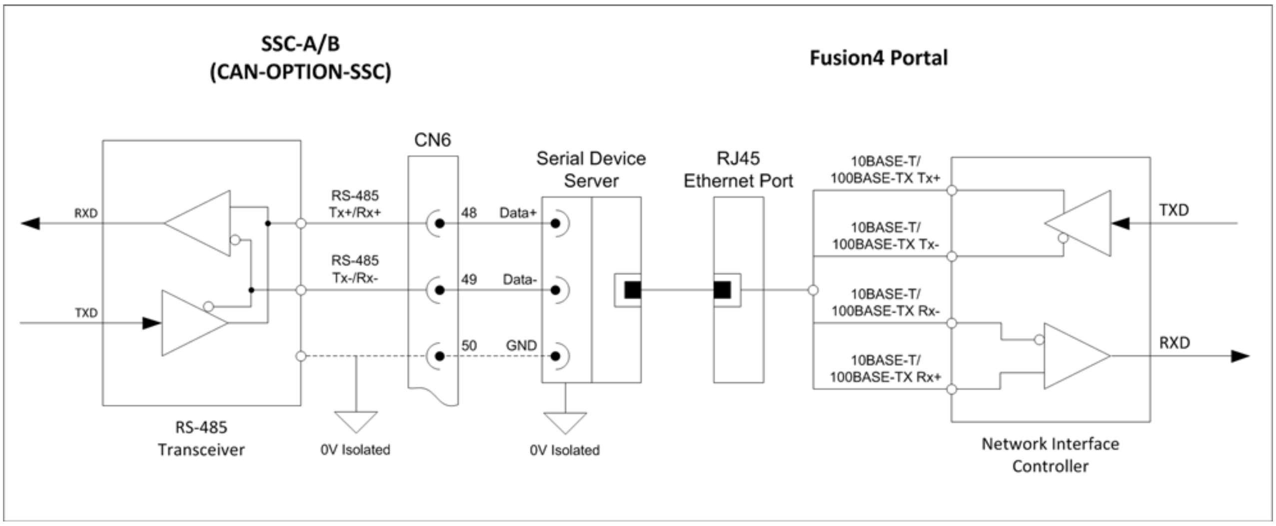

FIGURE 10-9 Serial to Ethernet Connection between Fusion4 SSC-A/SSC-B and Fusion4 Portal

10.7 Connecting Fusion4 SSC-A/SSC-B to Experion®

=> Future implementation

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CHAPTER 11 RS-485 WIRING FOR FUSION4 MSC-A

11.1 Introduction

The Fusion4 MSC-A (Multi-Stream Controller for Additive Injection)) is equipped with multiple RS-485 terminal connectors to enable the Fusion4 MSC-A to communicate with external devices via an RS-485 compliant serial connection.

The following connections are supported or will be supported in the future:

- Serial connection between Fusion4 MSC-A and Fusion4 MSC-L, see section 11.3
- Serial connection between Fusion4 MSC-A and 1010 B-series load computer, see section 11.4
- Serial connection between Fusion4 MSC-A and 1010 C-series load computer, see section 11.5
- Serial connection between Fusion4 MSC-A and a PC running Fusion4 Portal, see section 11.6
- Serial connection between Fusion4 MSC-A and a PC running Experion®

11.2 Fusion4 MSC-A Serial Connectivity

The Fusion4 MSC-A has three printed circuit boards each equipped with one more terminal connectors to connect the Fusion4 MSC-A to an external device via an RS-485 compliant connection.

- CAN-ARM-MSC-1 board, see section 11.2.1
- CAN-ARM-MSC-2 board, see section 11.2.2
- CAN-HMI-MSC board, see section 11.2.3

NOTE: See also the Installation & Operation Manual Fusion4 MSC-A for more information.

11.2.1 CAN-ARM-MSC-1 Board

The CAN-ARM-MSC-1 board features one terminal connector CN-146 consisting of two serial ports, namely COM-1 and COM-2. Both serial ports can be used to establish a 2-wire half-duplex RS-485 connection between the Fusion4 MSC-A and an external device. The serial ports are typically used to connect the Fusion4 MSC-A to an Fusion4 MSC-L or to a 1010 C-series load computer.

FIGURE 11-1 schematically shows a 2-wire half-duplex RS-485 connection between the Fusion4 MSC-A and an external device, using one of the serial ports of terminal connector CN-146.

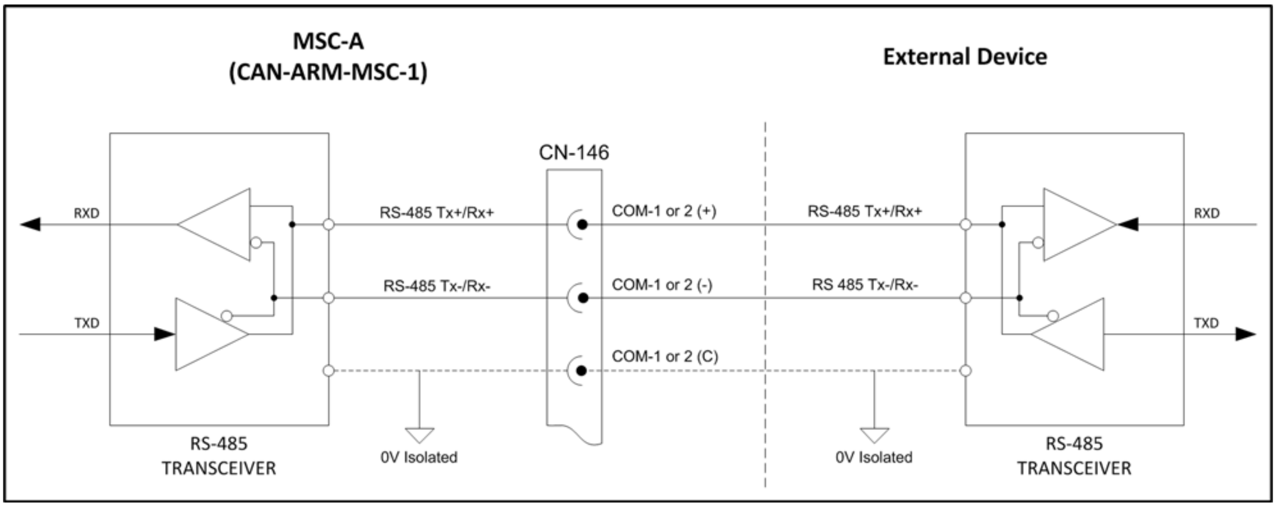

FIGURE 11-1 2-Wire Half-Duplex RS-485 Connection between Fusion4 MSC-A and External Device (CAN-ARM-MSC-1 Board)

TABLE 11-1 describes the layout of terminal connector CN-146.

TABLE 11-1 Layout of Terminal Connector CN-146

Connector		Signal Name	Signal Description
ID	Pin		
CN-146	COM-1 (+)	RS485_A	2W RS-485 Tx+/Rx+
	COM-1 (-)	RS485_B	2W RS-485 Tx-/Rx-
	COM-1 (C)	RS485_0V	0 Volt
	COM-2 (+)	RS485_A	2W RS-485 Tx+/Rx+
	COM-2 (-)	RS485_B	2W RS-485 Tx-/Rx-
	COM-2 (C)	RS485_0V	0 Volt

11.2.2 CAN-ARM-MSC-2 Board

The CAN-ARM-MSC-2 board features one terminal connector CN-246 consisting of two serial ports, namely COM-6 and COM-7. Both serial ports can be used to establish a 2-wire half-duplex RS-485 connection between the Fusion4 MSC-A and an external device. The serial ports are typically used to connect the Fusion4 MSC-A to an Fusion4 MSC-L or to a 1010 C-series load computer.

FIGURE 11-2 schematically shows a 2-wire half-duplex RS-485 connection between the Fusion4 MSC-A and an external device, using one of the serial ports of terminal connector CN-246.

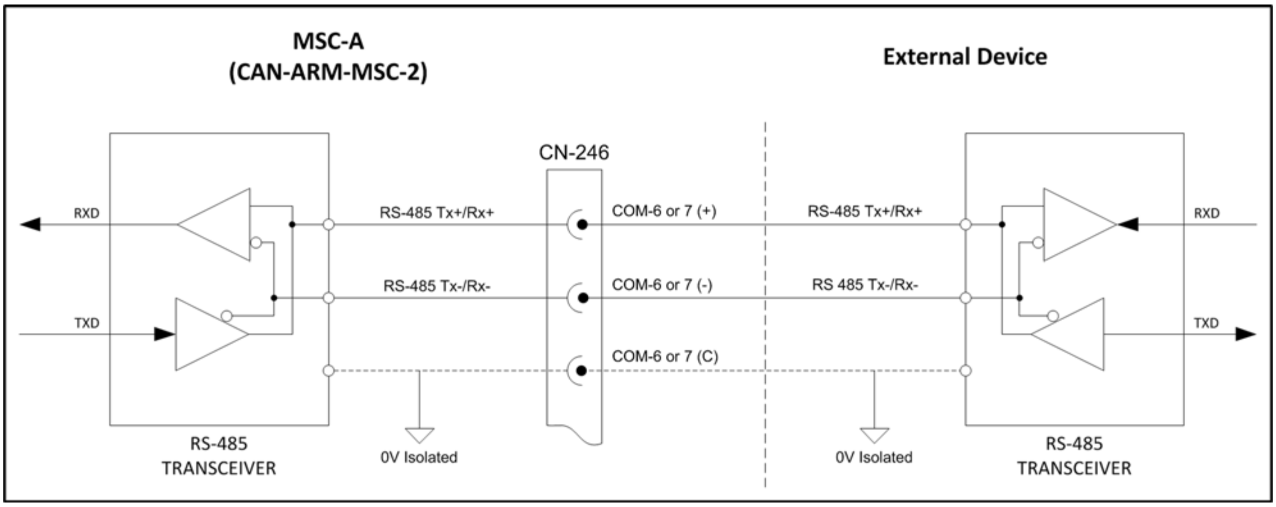

FIGURE 11-2 2-Wire Half-Duplex RS-485 Connection between Fusion4 MSC-A and External Device (CAN-ARM-MSC-2 Board)

TABLE 11-2 describes the layout of terminal connector CN-246.

TABLE 11-2 Layout of Terminal Connector CN-246

Connector		Signal Name	Signal Description
ID	Pin		
CN-246	COM-6 (+)	RS485_A	2W RS-485 Tx+/Rx+
	COM-6 (-)	RS485_B	2W RS-485 Tx-/Rx-
	COM-6 (C)	RS485_0V	0 Volt
	COM-7 (+)	RS485_A	2W RS-485 Tx+/Rx+
	COM-7 (-)	RS485_B	2W RS-485 Tx-/Rx-
	COM-7 (C)	RS485_0V	0 Volt

11.2.3 CAN-HMI-MSC Board

The CAN-HMI-MSC board features two terminal connectors that can be used to establish an RS-485 compliant connection between the Fusion4 MSC-A and an external device:

- Connector CN-150, see section 11.2.3.1
- Connector CN-151, see section 11.2.3.2

11.2.3.1 CAN-HMI-MSC Board: Connector CN-150

Terminal connector CN-150 features two serial ports, namely COM-3 and COM-4. Both serial ports can be used to establish a 2-wire half-duplex RS-485 connection between the Fusion4 MSC-A and an external device. The serial ports are typically used to connect the Fusion4 MSC-A to a PC running for example Fusion4 Portal.

FIGURE 11-3 schematically shows a 2-wire half-duplex RS-485 connection between the Fusion4 MSC-A and an external device, using one of the serial ports of terminal connector CN-150.

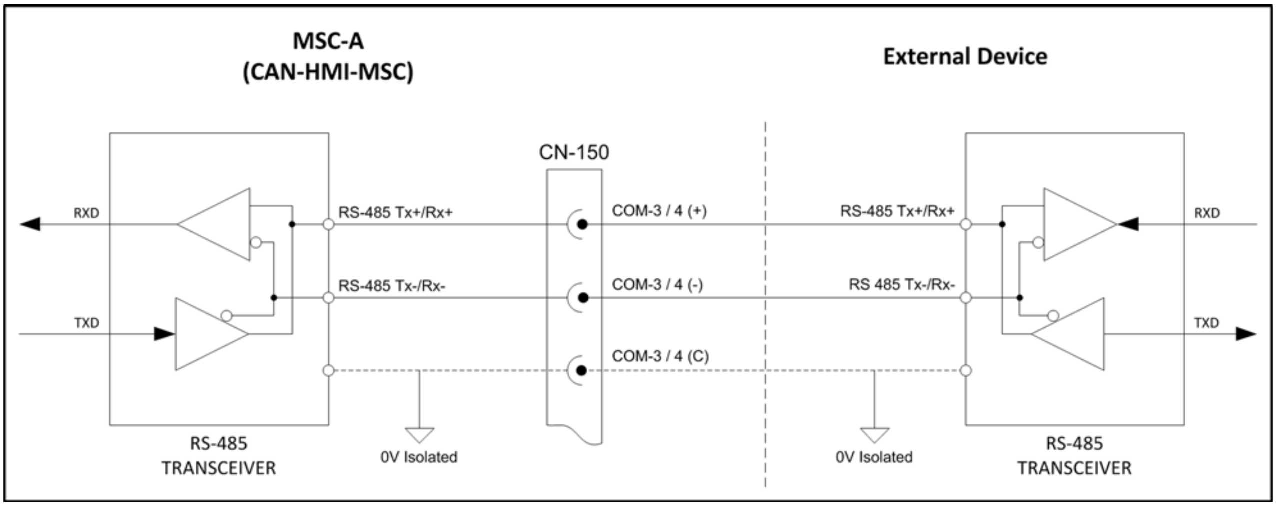

FIGURE 11-3 2-Wire Half-Duplex RS-485 Connection between Fusion4 MSC-A and External Device (CAN-HMI-MSC Board)

TABLE 11-3 describes the layout of terminal connector CN-150.

TABLE 11-3 Layout of Terminal Connector CN-150

Connector ID	Connector Pin	Signal Name	Signal Description
CN-150	COM-3 (+)	RS485_A	2W RS-485 Tx+/Rx+
	COM-3 (-)	RS485_B	2W RS-485 Tx-/Rx-
	COM-3 (C)	RS485_0V	0 Volt
	COM-4 (+)	RS485_A	2W RS-485 Tx+/Rx+
	COM-4 (-)	RS485_B	2W RS-485 Tx-/Rx-
	COM-4 (C)	RS485_0V	0 Volt

11.2.3.2 CAN-HMI-MSC Board: Connector CN-151

Terminal connector CN-151 can be used to establish a 4-wire full-duplex RS-422/485 connection between the Fusion4 MSC-A and an external device, for example the 1010 B-series load computer, Fusion4 MSC-L or a PC running for example Fusion4 Portal.

REMARKS:

1. In a 4-wire full-duplex RS-422/485 connection, the external device is always the master and the Fusion4 MSC-A is the slave.
2. When connecting the Fusion4 MSC-A, terminal connector CN-151 must be configured for 4-wire RS-485 communication using the RS COMM mode switch SW2 on the CAN-HMI-MSC board.
3. If the connection to the Fusion4 MSC-A represents the last link in a multi-drop bus, then the bus must be terminated by setting jumpers JP7 and JP8 on the CAN-HMI-MSC board to the right-hand (terminated) position. The serial bus will be terminated with a 120 Ohms resistor.

11.2.3.2.1 4-Wire Full-Duplex RS-485 Connection

FIGURE 11-4 schematically shows a 4-wire full-duplex RS-485 connection between the Fusion4 MSC-A and an external device.

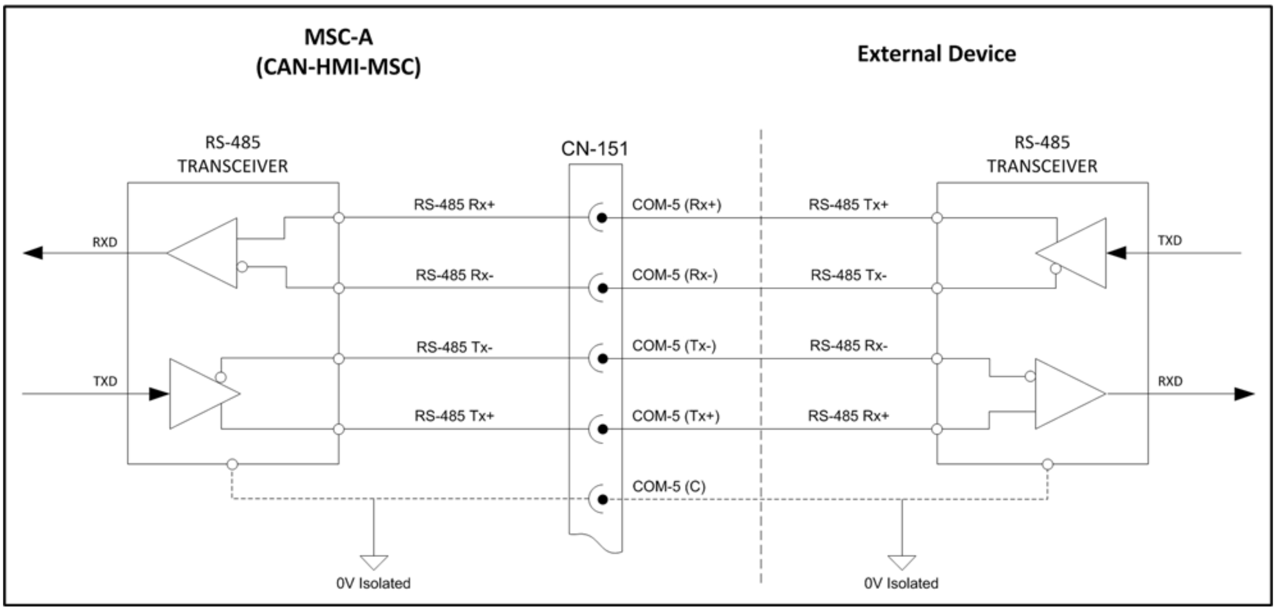

FIGURE 11-4 4-Wire Full-Duplex RS-485 Connection between Fusion4 MSC-A and External Device (CAN-HMI-MSC Board)

TABLE 11-4 describes the terminal layout of connector CN-151 in a 4-wire full-duplex RS-485 connection.

TABLE 11-4 Layout of Terminal Connector CN-151

Connector ID	Connector Pin	Signal Name	Signal Description
CN-151	COM-5 (Rx+)	RS485_A	4W RS-485 Rx+
	COM-5 (Rx-)	RS485_B	4W RS-485 Rx-
	COM-5 (Tx+)	RS485_Y	4W RS-485 Tx+
	COM-5 (Tx-)	RS485_Z	4W RS-485 Tx-
	COM-5 (C)	RS485_0V	0 Volt

11.2.3.2.2 4-Wire Full-Duplex RS-422 Connection

FIGURE 11-4 schematically shows a 4-wire full-duplex RS-485 connection between the Fusion4 MSC-A and an external device.

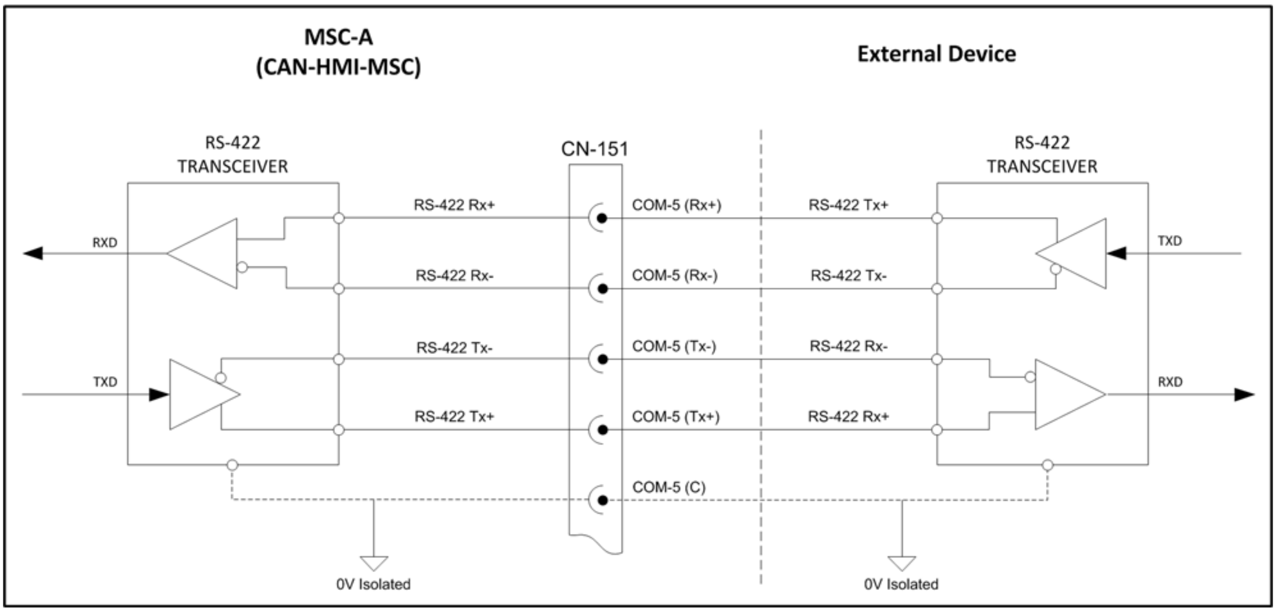

FIGURE 11-5 4-Wire Full-Duplex RS-422 Connection between Fusion4 MSC-A and External Device (CAN-HMI-MSC Board)

TABLE 11-4 describes the terminal layout of connector CN-151 in a 4-wire full-duplex RS-422 connection.

TABLE 11-5 Layout of Terminal Connector CN-151

Connector ID	Connector Pin	Signal Name	Signal Description
CN-151	COM-5 (Rx+)	Data In (+)	4W RS-485 Rx+
	COM-5 (Rx-)	Data In (-)	4W RS-485 Rx-
	COM-5 (Tx+)	Data Out (+)	4W RS-485 Tx+
	COM-5 (Tx-)	Data Out (-)	4W RS-485 Tx-
	COM-5 (C)	GROUND	0 Volt

11.3 Connecting Fusion4 MSC-A to Fusion4 MSC-L

=> Future implementation

11.4 Connecting Fusion4 MSC-A to 1010 B-Series

The Fusion4 MSC-A can be connected to a 1010 B-series load computer via a 4-wire full-duplex RS-422 serial connection. The following terminal connectors/serial ports must be used:

- Fusion4 MSC-A: terminal connector CN-151
- 1010 B-series: AUX port

REMARKS:

1. When connecting the Fusion4 MSC-A, terminal connector CN-151 must be configured for 4-wire RS-485 communication using the RS COMM mode switch SW2 on the CAN-HMI-MSC board.
2. If the connection to the Fusion4 MSC-A represents the last link in a multi-drop bus, then the bus must be terminated by setting jumper JP8 on the CAN-HMI-MSC board to the right-hand (terminated) position. The serial bus will be terminated with a 120 Ω resistor.
3. When connecting the 1010 B-series load computer, the AUX port must be set up for 4-wire RS-422 communication through modifying parameters by using the 1010 keyboard and HMI.

FIGURE 11-6 schematically shows a 4-wire full-duplex RS-422 connection between the Fusion4 MSC-A and the 1010 B-series load computer.

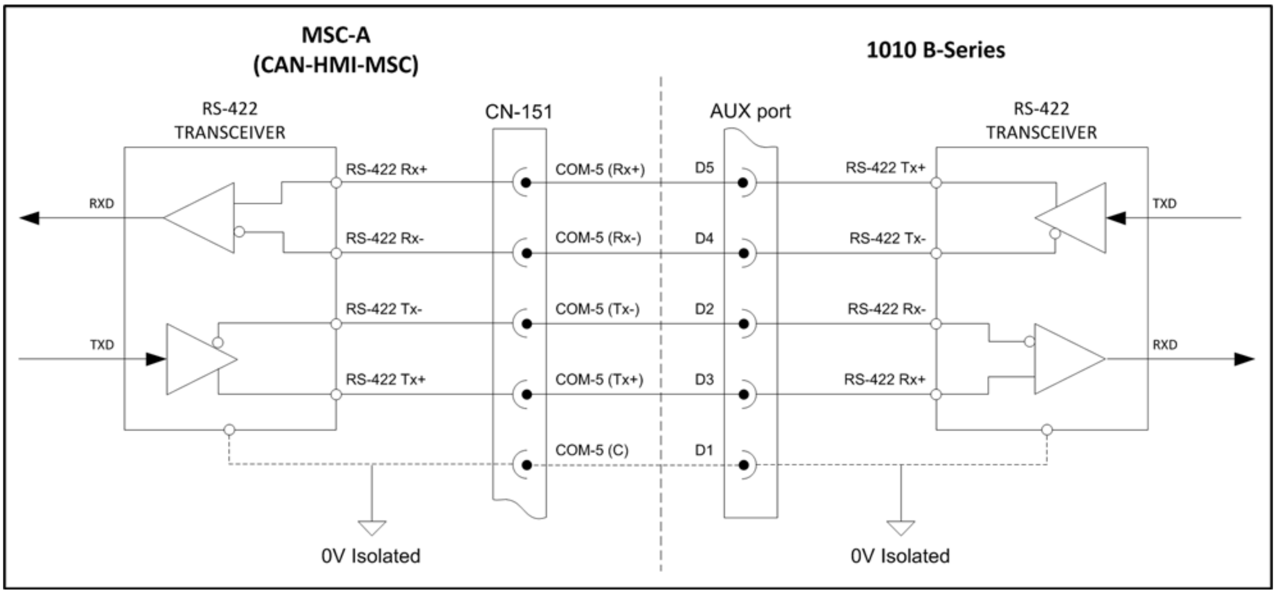

FIGURE 11-6 4-Wire Full-Duplex RS-422 Connection between Fusion4 MSC-A and 1010 B-Series

TABLE 6-6 describes the layout of the 1010 B-series AUX port.

TABLE 6-6 Layout of 1010 B-Series AUX Port

Connector		Signal Name	Signal Description
ID	Pin		
AUX port	D1	GROUND	0 Volt
	D2	Data In (-)	4W RS-422 Rx-
	D3	Data In (+)	4W RS-422 Rx+
	D4	Data Out (-)	4W RS-422 Tx-
	D5	Data Out (+)	4W RS-422 Tx+

NOTE: See also Model 1010A Application Pack BJ Wiring Diagrams and Programming Manual for more information.

11.5 Connecting Fusion4 MSC-A to 1010 C-Series

The Fusion4 MSC-A can be connected to a 1010 C-series load computer via 2-wire half-duplex RS-485 serial connection. The following terminal connectors/ports can be used:

- Fusion4 MSC-A: terminal connector CN-146, COM-1 or COM-2 (CAN-ARM-MSC-1 board), or terminal connector CN-246, COM-6 or COM-7 (CAN-ARM-MSC-1 board)
- 1010 C-series load computer: Port 2 or Port 3

REMARKS:

1. If the connection to the Fusion4 MSC-A represents the last link in a multi-drop bus, then the bus must be terminated by setting jumper JP8 on the CAN-ARM-MSC-1/CAN-ARM-MSC-2 board to the right-hand (terminated) position. The serial bus will be terminated with a 120 Ω resistor.
2. When connecting the 1010 C-series load computer, Port 2/Port 3 port must be set up for 2-wire RS-485 communication through modifying parameters by using the 1010 keyboard and HMI.

FIGURE 11-7 schematically shows a 2-wire half-duplex RS-485 connection between the Fusion4 MSC-A and the 1010 C-series load computer.

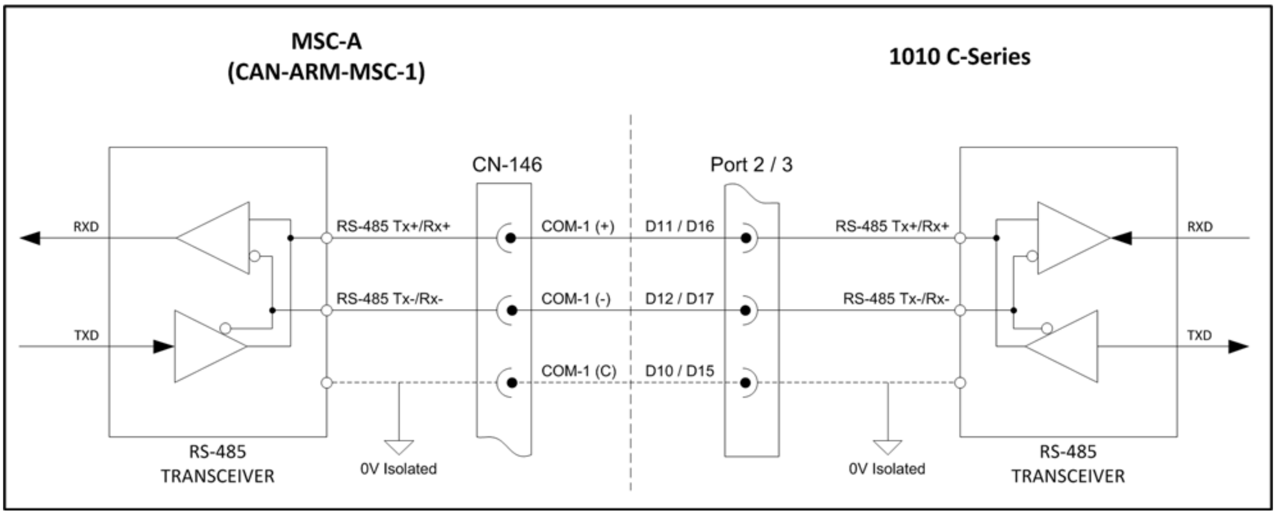

FIGURE 11-7 2-Wire half-duplex RS-485 connection between Fusion4 MSC-A and 1010 C-series

TABLE 6-7 describes the layout of 1010 C-series Port 2 and Port 3.

TABLE 6-7 Layout of 1010 C-Series Port 2 and Port 3

Connector		Signal Name	Signal Description
ID	Pin		
Connector 2	D10	RS485_0V	0 Volt
	D11	RS485_A	RS-485 2W Tx+/Rx+
	D12	RS485_B	RS-485 2W Tx-/Rx-
Connector 3	D15	RS485_0V	0 Volt
	D16	RS485_A	RS485 2W Tx+/Rx+
	D17	RS485_B	RS485 2W Tx-/Rx-

NOTE: See also the Card Descriptions and Wiring Manual Load Computer 1010 CB for more information.

11.6 Connecting Fusion4 MSC-A to Fusion4 Portal

There are a number of ways to connect the Fusion4 MSC-A to a PC running Fusion4 Portal, depending on the connectivity options of the PC:

- Serial connection between the Fusion4 MSC-A and the PC running Fusion4 Portal using an RS-232 to RS-422/485 converter, see section 11.6.1
- 2-Wire half-duplex or 4-wire full-duplex RS-485 connection between the Fusion4 MSC-A and the PC running Fusion4 Portal, see section 11.6.2
- Serial to Ethernet connection between the Fusion4 MSC-A and the PC running Fusion4 Portal using a serial device server, see section 11.6.3

NOTE: See also the Installation & Operation Manual Fusion4 Portal for more information.

11.6.1 RS-232 to RS-422/485 Converter

For the Fusion4 MSC-A to be connected to an RS-232 serial port on the PC running Fusion4 Portal, an RS-232 to RS-422/485 converter is required.

FIGURE 11-8 schematically shows a serial connection between the Fusion4 MSC-A and a PC running Fusion4 Portal, in which an RS-232 to RS-422/485 converter (e.g. Advantech ADAM 4520) is used.

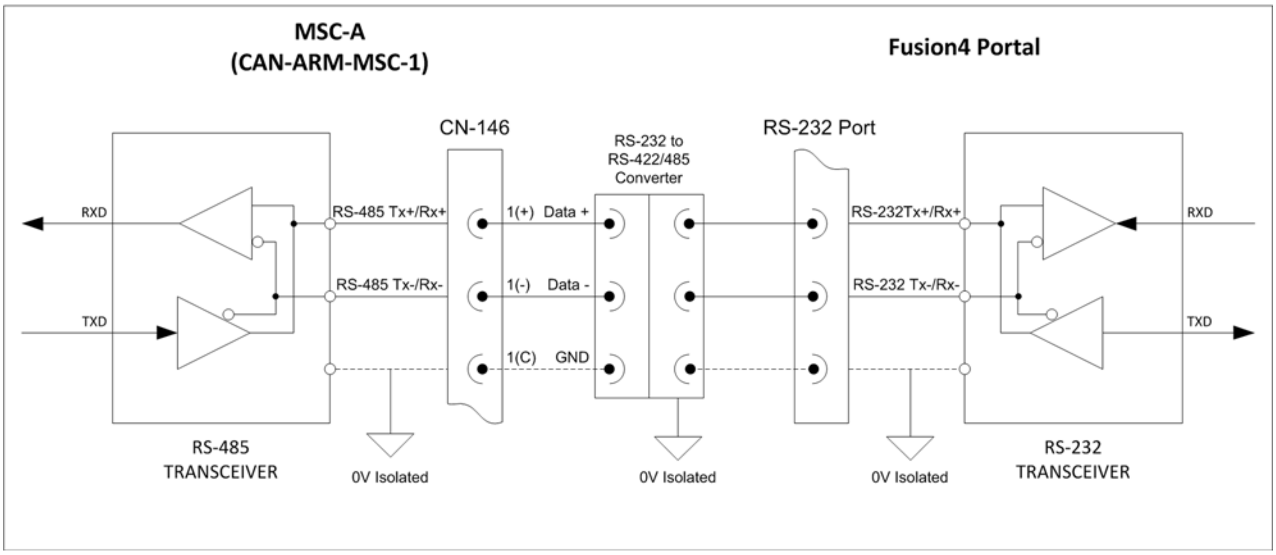

FIGURE 11-8 Connection Between Fusion4 MSC-A and Fusion4 Portal using RS-232 to RS-422/485 Converter

11.6.2 RS-485 Serial Connection

For the Fusion4 MSC-A to be connected directly to a PC running Fusion4 Portal, the PC must have an RS-485 serial port.

FIGURE 11-9 schematically shows a 2-wire half-duplex serial RS-485 connection between the Fusion4 MSC-A and a PC running Fusion4 Portal.

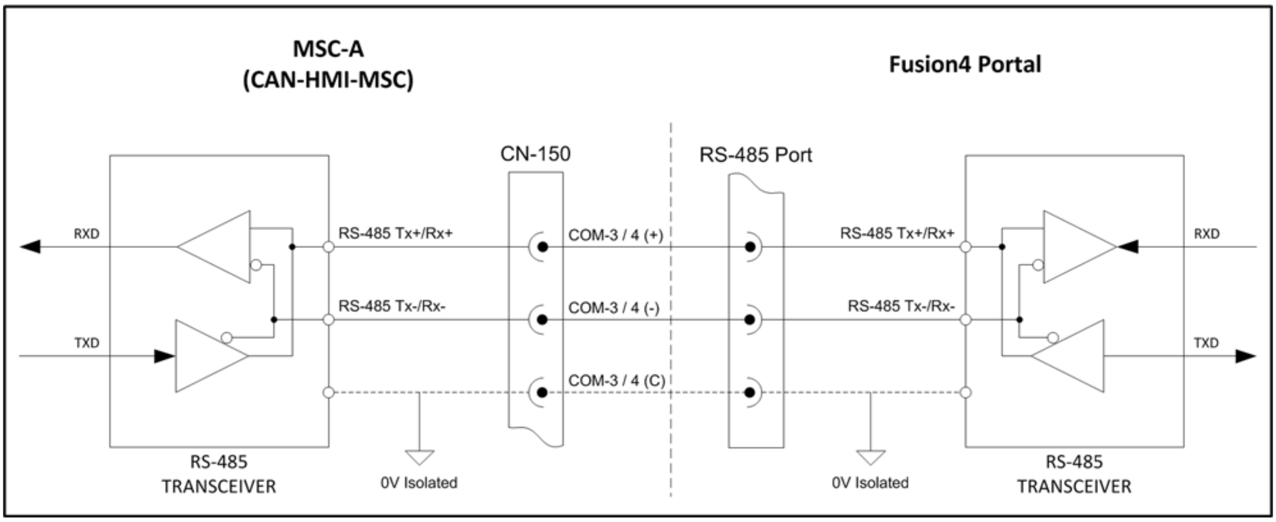

FIGURE 11-9 RS-485 2-Wire Half-Duplex Serial Connection between Fusion4 MSC-A and Fusion4 Portal

FIGURE 11-10 schematically shows a 4-wire full-duplex RS-485 connection between the Fusion4 MSC-A and a PC running Fusion4 Portal.

REMARKS:

1. When connecting the Fusion4 MSC-A, terminal connector CN-151 must be configured for 4-wire RS-485 communication using the RS COMM mode switch SW2 on the CAN-HMI-MSC board.
2. If the connection to the Fusion4 MSC-A represents the last link in a multi-drop bus, then the bus must be terminated by setting jumper JP8 on the CAN-HMI-MSC board to the right-hand (terminated) position. The serial bus will be terminated with a 120 Ω resistor.

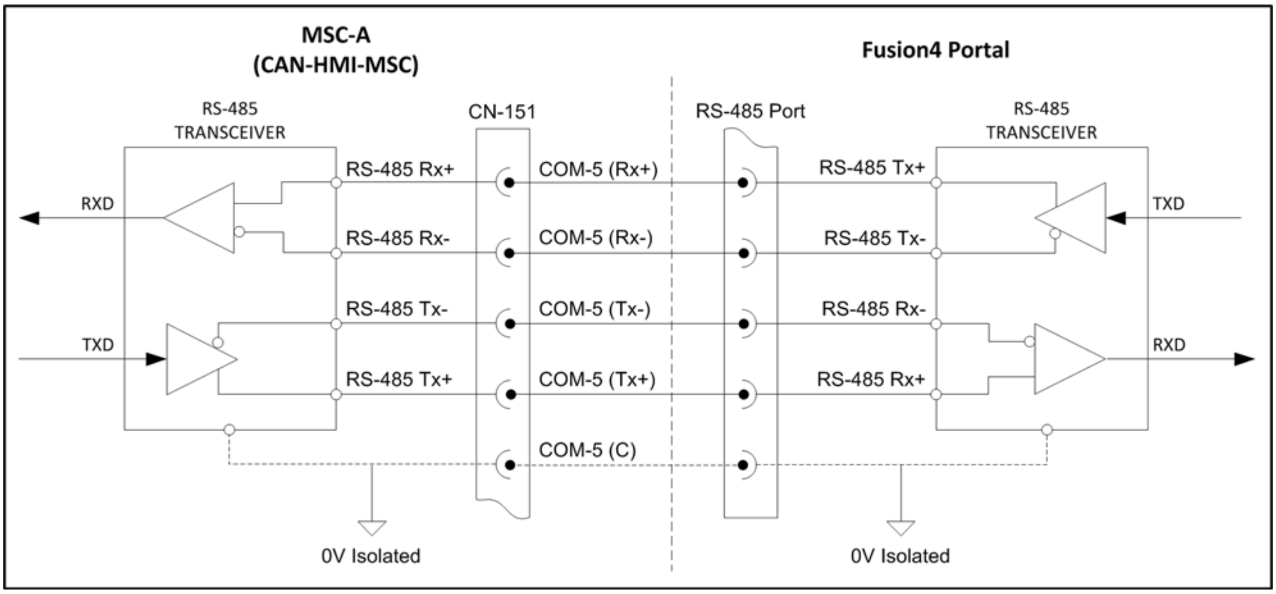

FIGURE 11-10 4-Wire Full-Duplex RS-485 Connection between Fusion4 MSC-A and Fusion4 Portal

11.6.3 Serial Device Server

For the Fusion4 MSC-A to be connected to an Ethernet port of a PC running Fusion4 Portal, a serial device server is required. The serial device server must support RS-422/485.

REMARK: Fusion4 Portal supports the serial device driver through Virtual COM and not through the TCP connection.

FIGURE 11-11 schematically shows a serial to Ethernet connection between the Fusion4 MSC-A and a PC running Fusion4 Portal, in which a a serial device server (e.g. Moxa NPort) is used.

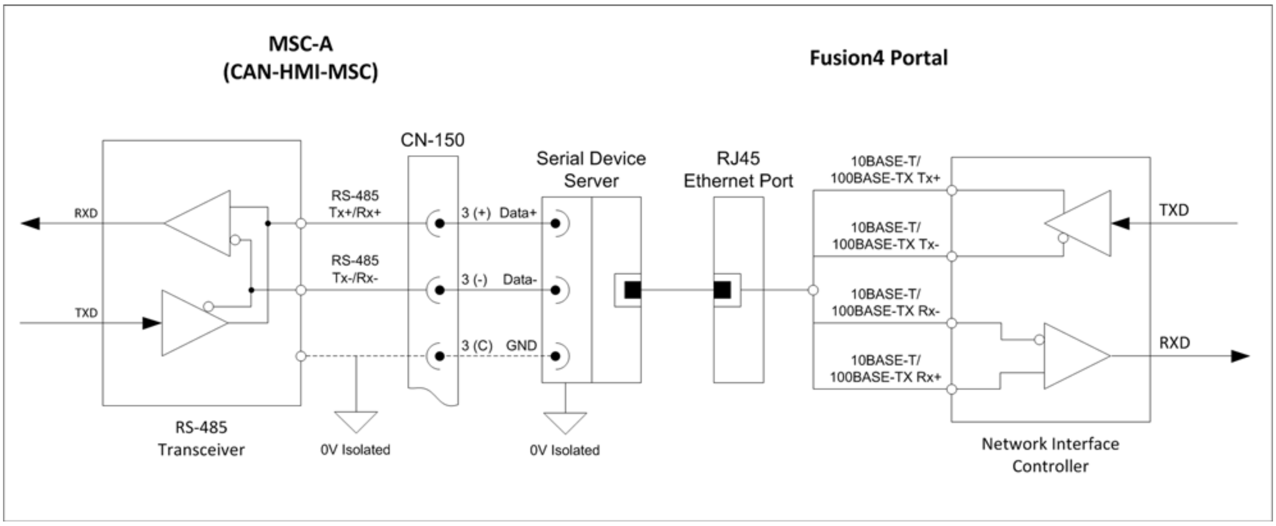

FIGURE 11-11 Serial to Ethernet Connection between Fusion4 MSC-A and Fusion4 Portal

11.7 Connecting Fusion4 MSC-A to Experion®

=> Future implementation

CHAPTER 12 RS-485 WIRING FOR FUSION4 MSC-L

12.1 Introduction

=> This section is under construction

12.2 Connecting Fusion4 MSC-L

=> Future implementation

12.3 Connecting Fusion4 MSC-L to Fusion4 Portal

=> Future implementation

12.4 Connecting Fusion4 MSC-L to Terminal Manager

=> Future implementation

12.5 Connecting Fusion4 MSC-L to Experion®

=> Future implementation

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CHAPTER 13 ETHERNET COMMUNICATIONS

13.1 Modbus TCP/IP Protocol

The Modbus messaging service provides a Client/Server communication between devices connected on an Ethernet TCP/IP network.

This client/server model is based on four types of messages:

- Modbus Request
  A Modbus Request is the message sent on the network by the Client to initiate a transaction.
- Modbus Indication
  A Modbus Indication is the Request message received on the Server side
- Modbus Response
  A Modbus Response is the Response message sent by the Server,
- Modbus Confirmation,
  A Modbus Confirmation is the Response Message received on the Client side

The Modbus messaging services (Client/Server Model) are used for real time information exchange between:

- Two device applications
- Device application and other device
- HMI/SCADA applications and devices
- PC and device program providing on line services

13.1.1 Protocol Description

A communicating system over Modbus TCP/IP may include different types of device:

- A Modbus TCP/IP Client and Server devices connected to a TCP/IP network
- The Interconnection devices like bridge, router or gateway for inter-connection between the TCP/IP network and a serial line sub-network which permit connections of Modbus Serial line Client and Server end devices.

The Modbus protocol defines a simple Protocol Data Unit (PDU) independent of the underlying communication layers. The mapping of

Modbus protocol on specific buses or networks can introduce some additional fields on the Application Data Unit (ADU).

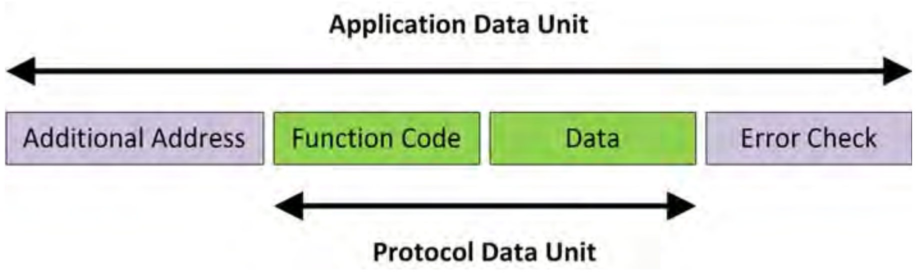

FIGURE 13-1 General Modbus Frame

The client that initiates a Modbus transaction builds the Modbus Application Data Unit. The function code indicates to the server which kind of action to perform.

13.1.1.1 Modbus On TCP/IP Application Data Unit

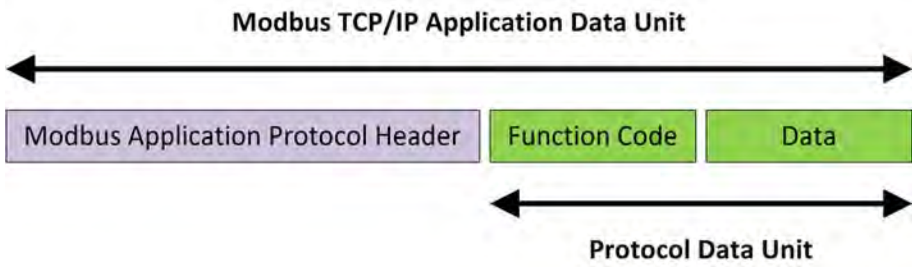

FIGURE 13-2 Modbus Request/Response over TCP/IP

A dedicated header is used on TCP/IP to identify the Modbus Application Data Unit. It is called the MBAP header (Modbus Application Protocol header).

This header provides some differences compared to the Modbus RTU application data unit used on serial line:

- The Modbus ‘slave address’ field usually used on Modbus Serial Line is replaced by a single byte ‘Unit Identifier’ within the MBAP Header. The ‘Unit Identifier’ is used to communicate via devices such as bridges, routers and gateways that use a single IP address to support multiple independent Modbus end units.
- All Modbus requests and responses are designed in such a way that the recipient can verify that a message is finished. For function codes where the Modbus PDU has a fixed length, the function code alone is sufficient. For function codes carrying a variable amount of data in the request or response, the data field includes a byte count.

- When Modbus is carried over TCP, additional length information is carried in the MBAP header to allow the recipient to recognize message boundaries even if the message has been split into multiple packets for transmission. The existence of explicit and implicit length rules, and use of a CRC-32 error check code (on Ethernet) results in an infinitesimal chance of undetected corruption to a request or response message.

13.1.1.2 MBAP Header description

The MBAP Header contains the following fields:

Fields	Length	Description	Client	Server
Transaction Identifier	2 Bytes	Identification of a Modbus Request / Response transaction.	Initialized by the client	Recopied by the server from the received request
Protocol Identifier	2 Bytes	0 = Modbus protocol	Initialized by the client	Initialized by the server (See Response)
Length	2 Bytes	Number of following bytes	Initialized by the client (request)	Recopied by the server from the received request
Unit Identifier	1 Byte	Identification of a remote slave connected on a serial line or on other buses.	Initialized by the client	Recopied by the server from the received request

The header is 7 bytes long:

- Transaction Identifier - It is used for transaction pairing, the Modbus server copies in the response the transaction identifier of the request.
- Protocol Identifier – It is used for intra-system multiplexing. The Modbus protocol is identified by the value 0.
- Length - The length field is a byte count of the following fields, including the Unit Identifier and data fields.
- Unit Identifier – This field is used for intra-system routing purpose. It is typically used to communicate to a Modbus+ or a Modbus serial line slave through a gateway between an Ethernet TCP/IP network and a Modbus serial line. This field is set by the Modbus Client in the request and must be returned with the same value in the response by the server.

All Modbus TCP ADU are sent via TCP to registered port 502.

13.1.1.3 Modbus Functions Codes Description

See section 7.3 for more information.

13.2 Fusion4 MSC-A

13.2.1 Connecting Fusion4 MSC-A to Ethernet Network

The Fusion4 MSC-A (Multi-Stream Controller for Additive Injection) houses three boards each equipped with an Ethernet terminal connector:

- CAN-ARM-MSC-1 board: terminal connector CN-147
- CAN-ARM-MSC-2 board: terminal connector CN-247
- CAN-HMI-MSC board: terminal connector CN-152

Each terminal connector allows the Fusion4 MSC-A to communicate with external devices via an 802.3i 10BASE-T / 802.3u 100BASE-TX compliant connection. The following connections are supported or will be supported in the future:

- Ethernet connection between the Fusion4 MSC-A and a Fusion4 MSC-L (Multi-Stream Controller for Loading), see section 13.2.2
- Ethernet connection between the Fusion4 MSC-A and a PC running Fusion4 Portal, see section 13.2.2
- Ethernet connection between the Fusion4 MSC-A and a PC running Experion®, see section 13.2.4

13.2.2 Connecting Fusion4 MSC-A to MSC-L over Ethernet

=> Future implementation

13.2.3 Connecting Fusion4 MSC-A to Fusion4 Portal over Ethernet

=> Future implementation

13.2.4 Connecting Fusion4 MSC-A to Experion® over Ethernet

=> Future implementation

13.3 Fusion4 MSC-L

=> Future implementation

CHAPTER 14 PORTAL OPC

14.1 Introduction

Fusion4 Portal features an OPC server named Fusion4. Fusion4 OPC server communicates with the 1010CB device over COM port and exposes real time values, transaction details and alarms as OPC items to external clients. The Terminal Automation System (TAS) subscribes as one of the OPC clients to retrieve the data change of these OPC items. TAS can issue the commands to the 1010CB device through Fusion4 OPC server. When the transactions are ready the Bill of Lading is printed by Fusion4 Portal.

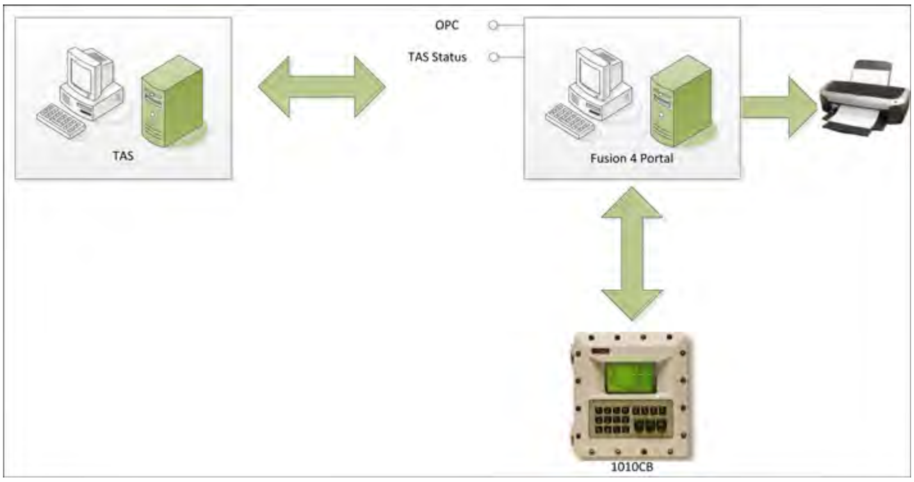

FIGURE 14-1

Fusion4 OPC server offers OPC clients to:

- Read or subscribe to one or more OPC items
- Set manual density
- Read/subscribe to alarms at the connected device, acknowledge them

Following are some possible OPC clients for Fusion4 OPC server:

- Any Terminal Automation System, like Honeywell Terminal Manager, to achieve the workflow for a transaction at the loading bay with 1010CB
- Any SCADA system, like Honeywell Experion®, that uses the values for operator displays

14.1.1 Available licenses for OPC Clients

The license identification code determines the behavior of Fusion4 OPC Server, see FIGURE 14-2.

- When position 8 is “S” only 2 client connections are possible.
- When position 8 is “T” only 5 client connections are possible.
- When position 8 is “V” an unlimited number of client connections are possible.
- When position 8 is “N” Fusion4 OPC server will not have any OPC items in its namespace.

.

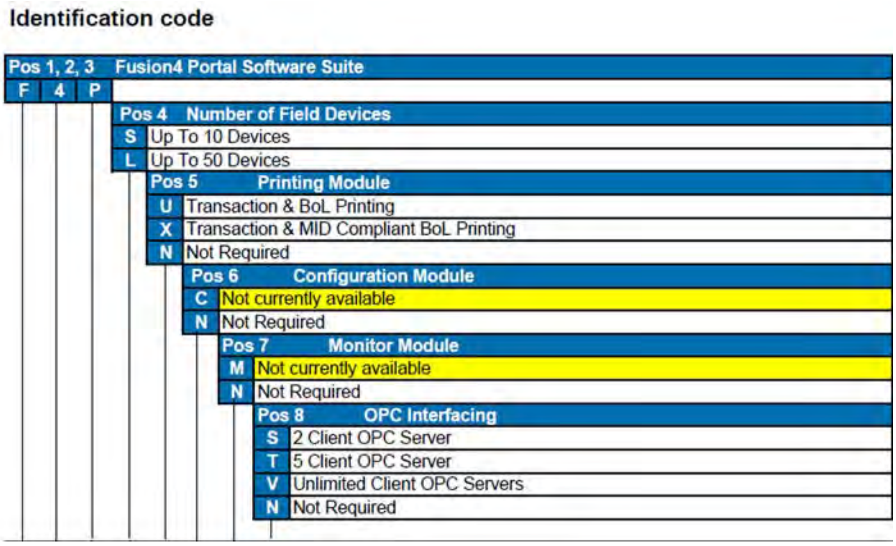

FIGURE 14-2 License Identification Code

14.1.2 DCOM Configuration

REMARK: This information in this section applies to both the Fusion4 OPC Server machine and the Client machine.

There are three steps involved in setting up DCOM for remote access.

- Changing the Windows fire wall settings (see section 14.1.2.1)
- Checking presence of “mngr” account on server and client machine (see section 14.1.2.2)
- Configuring the DCOM machine default settings (see section 14.1.2.3)

14.1.2.1 Windows Fire Wall Setting

By default the Windows fire wall is switched on. If the machine is sufficiently protected behind a corporate fire wall, it may be appropriate to permanently turn off the individual Windows fire wall. When switched off, the individual fire wall settings outlined here need not be performed to allow OPC communication.

14.1.2.2 User Accounts

Ensure that local machine “mngr” account is present at both the server and client machine with the same password.

14.1.2.3 DCOM Machine Default Settings

Perform the following steps to configure the DCOM machine default settings to enable OPC communications:

1. Go to **Start** | **Run...**.
   The *Run* window is displayed.

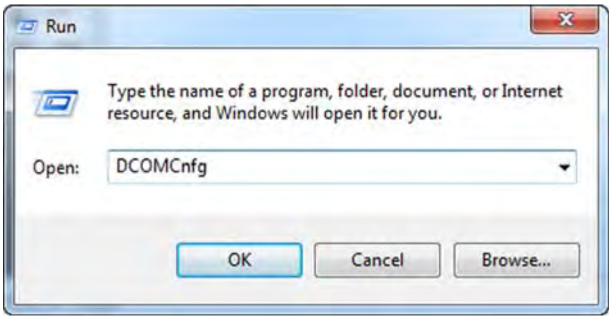

FIGURE 14-3 *Run* window

*NOTE: If Run... is not displayed in the Start menu: (1) Right-click on the **Start** icon and select **Properties** from the pop-up menu; (2) In the Task bar and Start Menu Properties window go to the Start Menu tab; (3) Click **Customize...**; (4) Select the **Run command** check box; (5) Click **OK** to save the changes and to close the window, (6) Click **Apply** and then **OK** to save the changes and to close the window.*

2. In the text field after Open: enter **DCOMCnfg** and click **OK**.
   The *Component Services* window is displayed.

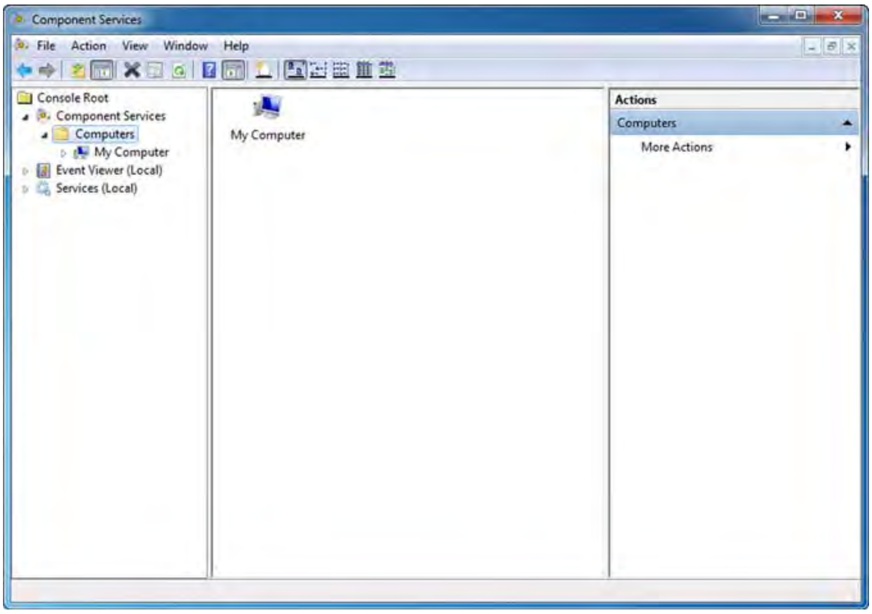

FIGURE 14-4 *Component Services* window

3. Under *Console Root* double-click **Component Services** to expand it.
4. Under *Component Services* double-click **Computers** to expand it.

5. In the pane on the right, right click on **My Computer** and select **Properties**.
   The *My Computer Properties* window is displayed.

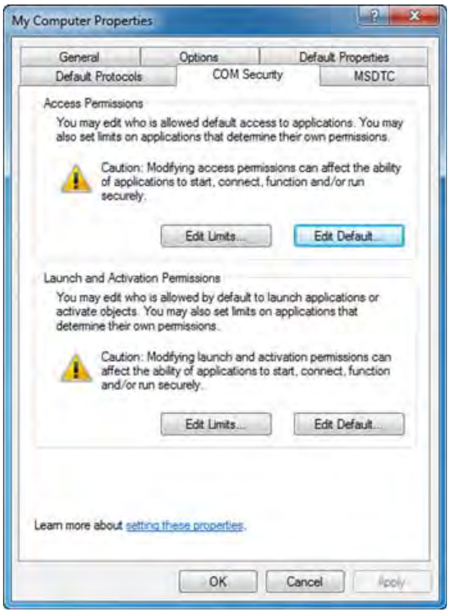

FIGURE 14-5 *My Computer Properties* window

6. Go to the tab **COM Security**.

7. Under *Access Permissions* click **Edit Limits...**.
   The *Access Permissions* window is displayed.

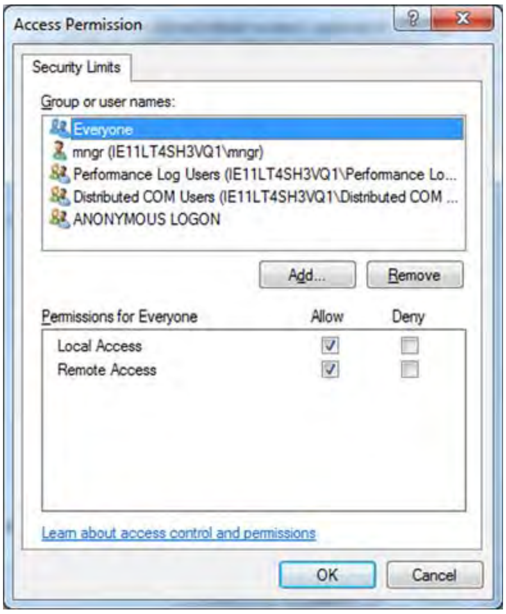

FIGURE 14-6 *Access Permissions* window - Security Limits

8. Check the **Local Access** and **Remote Access** check boxes for the following user accounts: **Everyone**, **mngr** and **ANONYMOUS LOGIN**. Click **OK** to save the changes and to close the window.
   You will return to the *My Computer Properties* window.

9. Under *Access Permissions* click **Edit Default...**.
   The *Access Permissions* window is displayed.

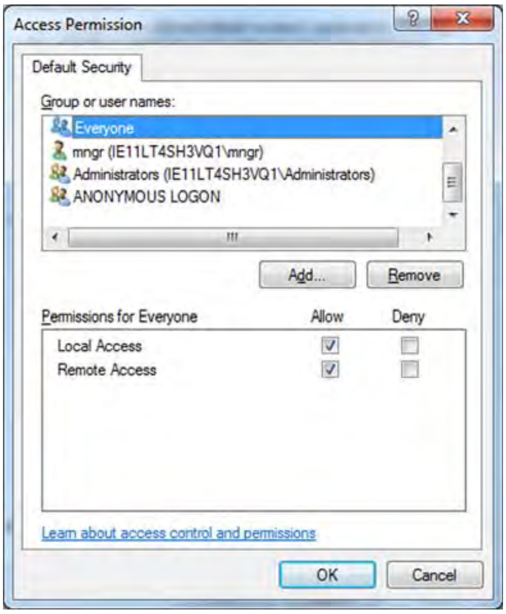

FIGURE 14-7 *Access Permissions* window - Default Security

10. Check the **Local Access** and **Remote Access** check boxes for the following user accounts: **Everyone**, **mngr** and **ANONYMOUS LOGIN**. Click **OK** to save the changes and to close the window.

    You will return to the *My Computer Properties* window.

11.Under *Launch and Activation Permissions* click **Edit Limits...**.
The *Launch and Activation Permissions* window is displayed.

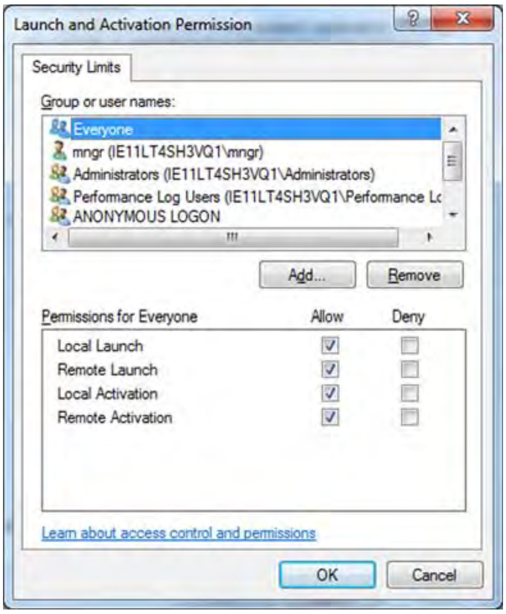

FIGURE 14-8 *Launch and Activation Permissions* window - Security Limits

12.Check the **Local Launch**, **Remote Launch**, **Local Activation** and **Remote Activation** check boxes for the following user accounts: **Everyone**, **mngr** and **ANONYMOUS LOGIN**. Click **OK** to save the changes and to close the window.
You will return to the *My Computer Properties* window.

13. Click **Edit Default...** under Launch and *Activation Permissions*.
    The *Launch and Activation Permissions* window is displayed.

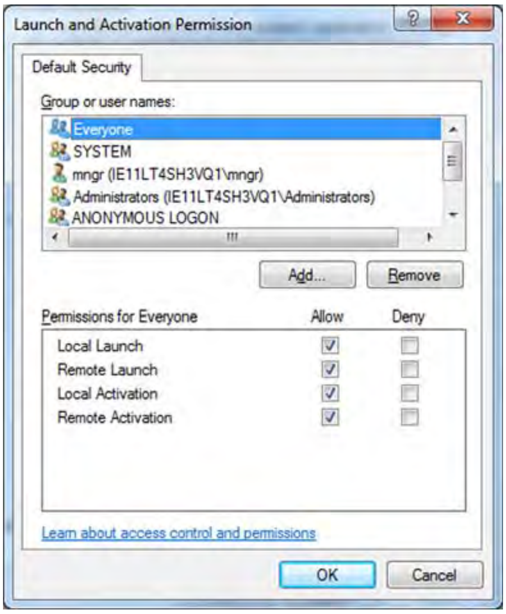

FIGURE 14-9 *Launch and Activation Permissions* window - Default Security

14. Check the **Local Launch**, **Remote Launch**, **Local Activation** and **Remote Activation** check boxes for the following user accounts: **Everyone**, **mngr** and **ANONYMOUS LOGIN**. Click **OK** to save the changes and to close the window.
    You will return to the *My Computer Properties* window.
15. Click **OK** to save all changes and to close the window.

14.1.3 Prerequisites for OPC Client Machine

14.1.3.1 OPC Core Components

As a prerequisite OPC core components 2.00.220 or higher is required. Please visit http://www.opcfoundation.org/ to download the latest version. A version can also be found on the Fusion4 Portal CD at <<root>>/Fusion4_Portal_R120/OPC Core Components 2.00 Redistributable 2.20.msi.

14.1.3.2 Check Logon Permission between Client and Server

Client and Server machines need logon permissions set at both ends. This can be checked on the server by typing **\\<<Client machine ip>>** at the server machine's Windows browser. Check if you get an "Access denied error". In that case contact your administrator to provide the necessary logon rights for server machine on the client machine. Similarly, type **\\<<server machine IP>>** on the client machine. Assign the necessary logon rights for the client machine on the server machine if required. Restart both client and server machine.

14.1.4 Prerequisites for Visual Basic OPC Client Machine

Fusion4 OPC server can be connected from a Visual Basic 6 client. However, the client may need additional dependencies to achieve such a solution. Contact the vendor of such a client application for more details.

14.1.5 TAS/OPC acquiring Information from Fusion4 OPC Server

14.1.5.1 Setting Type of TAS Status for Site

Fusion4 Portal Configuration enables you to set the type of TAS status. The type of TAS status indicates whether TAS is online or offline.

REMARK: After you set the type of TAS status you need to restart Fusion4 Portal for the settings to come into effect.

To set the type of TAS status for a site:

1. From the *Start* menu select **All Programs** | **Enraf** | **Fusion4 Portal**.
   The main window of *Fusion4 Portal* is displayed.
2. In the navigation tree on the left click **Settings** under the selected site.
   The properties of the site are displayed.

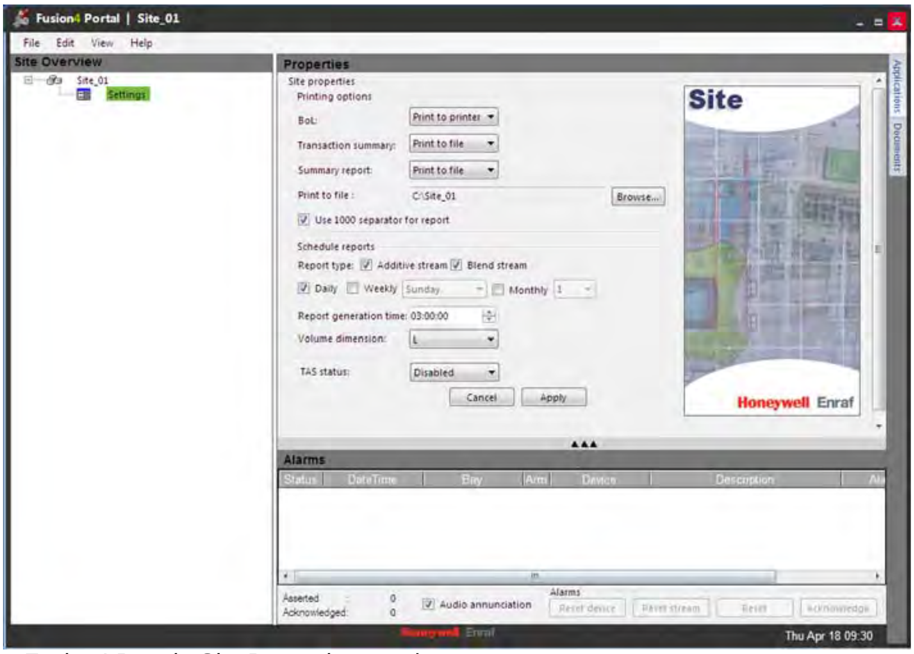

FIGURE 14-10 *Fusion4 Portal - Site Properties* panel

3. Select the type of TAS status from the selection list box. The types of TAS status are described in TABLE 14-1.

TABLE 14-1 TAS Status Types

Type	Description
Binary	If TAS is running the value of the OPC item is set to TRUE If TAS is not running the value of the OPC item is set to FALSE If TAS is not running Fusion4 Portal will stop scanning the devices, resulting in a “TAS COMMUNICATION FAILURE” message displayed on the 1010CB.
Time Ticker	TAS indicates its presence by continuously changing the value of the OPC item. If the changing of the value stops, then Fusion4 OPC server will behave as if the TAS is absent. If TAS is not running Fusion4 Portal will stop scanning the devices, resulting in a “TAS COMMUNICATION FAILURE” message displayed on the 1010CB.
Disabled	Fusion4 Portal will not consider the status of TAS. Irrespective whether TAS is present or absent Fusion4 OPC Server will continue to scan the devices.

14.1.5.2 COM Port Settings and Refresh Rate

Fusion4 Portal Configuration enables you to set the time out period (in ms) and the turn around delay (TAD, in ms) for a COM port. The recommended TAD settings is a maximum of (a) and (b), where (a) is equal to 200 ms / No. COM ports configured in the site tree and (b) is equal to [(10 ms * No. of devices under the parent COM port) + 30 ms].

REMARK: After you set the time out period and/or TAD for a COM Port you need to restart Fusion4 Portal for the settings to come into effect.

14.1.6 OPC Value, Quality and Timestamp Properties

Every OPC item on the Fusion4 OPC server has three properties that fully qualifies the item:

- Value
  The value of an OPC item is the last value that Fusion4 OPC server stored for that particular item.
- Quality
  Quality represents the characteristics of the value updated on the server cache. Quality is represented as a 2 byte unsigned integer. There can be 3 possible values in Fusion4 Portal
  - Good - 0xC0 (decimal 192
  - Uncertain - 0x50 (decimal 80)
  - Bad - 0x00 (decimal 0)
  - Bad Last Known 0x14 (decimal 20)

- Timestamp
  Timestamp represents the latest date and time when the value was updated on the server cache.

14.1.7 Subscription

Fusion4 OPC server will intelligently optimize interaction with the connected device(s) themselves, based on the OPC items needed by connected TAS/ OPC Client systems. Hence it is required for TAS/ OPC Client to subscribe certain OPC items, subscribe in the sense some of the OPC items needs to be part of OPC refresh group at the client side.

TABLE 14-2 lists the supported OPC items for subscription:

TABLE 14-2 OPC items available for subscription

Command	Transaction Phase	OPC items to subscribe to
PR	After initiation of compartment load	[B].[D].PR.1.A1Preset [B].[D].PR.1.A2Preset [B].[D].PR.1.A3Preset [B].[D].PR.1.A4Preset [B].[D].PR.1.BayNum
IV[n]	Loading	[B].[D].A[n].FlowRate [B].[D].A[n].GOV [B].[D].A[n].GOVacc [B].[D].A[n].GSV [B].[D].A[n].GSVacc [B].[D].A[n].M1.FlowRate [B].[D].A[n].M1.GOV [B].[D].A[n].M1.GOVacc [B].[D].A[n].M1.GSV [B].[D].A[n].M1.GSVacc [B].[D].A[n].M1.Press [B].[D].A[n].M1.RefDensity [B].[D].A[n].M1.Temp [B].[D].A[n].M2.FlowRate [B].[D].A[n].M2.GOV [B].[D].A[n].M2.GOVacc [B].[D].A[n].M2.GSV [B].[D].A[n].M2.GSVacc [B].[D].A[n].M2.Press [B].[D].A[n].M2.RefDensity [B].[D].A[n].M2.Temp
TB	Loading	[B].[D].TB.A1CurrentRatio [B].[D].TB.A1TargetRatio [B].[D].TB.A2CurrentRatio [B].[D].TB.A2TargetRatio [B].[D].TB.BayNum [B].[D].TB.FirstArmNum [B].[D].TB.TotalArms

Command	Transaction Phase	OPC items to subscribe to
TF	Loading	[B].[D].TF.1.A1FlowRate [B].[D].TF.1.A1TargetFlowRate [B].[D].TF.1.A2FlowRate [B].[D].TF.1.A2TargetFlowRate [B].[D].TF.1.A3FlowRate [B].[D].TF.1.A3TargetFlowRate [B].[D].TF.1.A4FlowRate [B].[D].TF.1.A4TargetFlowRate [B].[D].TF.1.BayNum [B].[D].TF.1.FirstArmNum [B].[D].TF.1.TotalArms
BT[n]	After loading of compartment is completed	[B].[D].A[n].Load.ArmNo [B].[D].A[n].Load.BatchComplete [B].[D].A[n].Load.BatchNo [B].[D].A[n].Load.BlendAcy [B].[D].A[n].Load.BlendType [B].[D].A[n].Load.CheckSum [B].[D].A[n].Load.CompNo [B].[D].A[n].Load.Error [B].[D].A[n].Load.PresetQty [B].[D].A[n].Load.RecipeID [B].[D].A[n].Load.ReturnQty [B].[D].A[n].Load.StartTime [B].[D].A[n].Load.StopTime [B].[D].A[n].Load.TransNo [B].[D].A[n].Load.Units [B].[D].A[n].LoadAdditive.Quantity1 [B].[D].A[n].LoadAdditive.Quantity2 [B].[D].A[n].LoadAdditive.Quantity3 [B].[D].A[n].LoadAdditive.Quantity4 [B].[D].A[n].LoadAdditive.Quantity5 [B].[D].A[n].LoadAdditive.Quantity6 [B].[D].A[n].LoadAdditive.BatchNo [B].[D].A[n].LoadAdditive.TransNo [B].[D].A[n].LoadBase.BatchNo [B].[D].A[n].LoadBase.CheckSum [B].[D].A[n].LoadBase.Commodity [B].[D].A[n].LoadBase.DensFWA [B].[D].A[n].LoadBase.Error [B].[D].A[n].LoadBase.ExpFactor [B].[D].A[n].LoadBase.GOV [B].[D].A[n].LoadBase.GOVaccAft [B].[D].A[n].LoadBase.GOVaccBef [B].[D].A[n].LoadBase.GSV [B].[D].A[n].LoadBase.GSVaccAft [B].[D].A[n].LoadBase.GSVaccBef [B].[D].A[n].LoadBase.MeterNo [B].[D].A[n].LoadBase.Preset [B].[D].A[n].LoadBase.PressFWA [B].[D].A[n].LoadBase.ProdDensObs [B].[D].A[n].LoadBase.TempFWA [B].[D].A[n].LoadBase.TransNo [B].[D].A[n].LoadBlend.BatchNo [B].[D].A[n].LoadBlend.CheckSum

Command	Transaction Phase	OPC items to subscribe to
		[B].[D].A[n].LoadBlend.Commodity [B].[D].A[n].LoadBlend.DensFWA [B].[D].A[n].LoadBlend.Error [B].[D].A[n].LoadBlend.ExpFactor [B].[D].A[n].LoadBlend.TempFWA [B].[D].A[n].LoadBlend.TransNo [B].[D].A[n].LoadBlend.GOV [B].[D].A[n].LoadBlend.GOVaccAft [B].[D].A[n].LoadBlend.GOVaccBef [B].[D].A[n].LoadBlend.GSV [B].[D].A[n].LoadBlend.GSVaccAft [B].[D].A[n].LoadBlend.GSVaccBef [B].[D].A[n].LoadBlend.MeterNo [B].[D].A[n].LoadBlend.Preset [B].[D].A[n].LoadBlend.PressFWA [B].[D].A[n].LoadBlend.ProdDensObs
AM	After a transaction is completed	[B].[D].AM.[n].ArmErrStatus [B].[D].AM.[n].ArmInterruptStatus [B].[D].AM.[n].ArmNum [B].[D].AM.[n].ArmStatus [B].[D].AM.[n].M1ErrStatus [B].[D].AM.[n].M2ErrStatus [B].[D].AM.[n].SysInterruptStatus
ST	After a transaction is completed	[B].[D].ST.BayNum [B].[D].ST.CalibNum [B].[D].ST.FirstArmNum [B].[D].ST.LoadNum [B].[D].ST.MasterIndex [B].[D].ST.PerIndex [B].[D].ST.PowCycCount [B].[D].ST.RefNum [B].[D].ST.Result [B].[D].ST.StartBatch [B].[D].ST.StartDate [B].[D].ST.StartTime [B].[D].ST.StopBatch [B].[D].ST.StopTime [B].[D].ST.TASMode [B].[D].ST.TotalArms [B].[D].ST.TransNum [B].[D].ST.UniqueNum [B].[D].ST.UnitAddress [B].[D].ST.VehIndexT
AL	Alarm	See section 14.5.
GD	Get date and time	[B].[D].GD.Date [B].[D].GD.Time

14.1.8 Sales Codes

The type of 1010CB device configured determines the 1010CB OPC items that will be created by Fusion4 OPC server. The type of 1010CB device is defined in the sales code.

Fusion4 Portal enables you to set the sales code for a 1010CB device:

REMARK: After you set the sales code for a 1010CB device you need to restart Fusion4 Portal for the setting to come into effect.

1. From the *Start* menu select **All Programs** | **Enraf** | **Fusion4 Portal**. The main window of *Fusion4 Portal* is displayed.
2. Select the 1010CB device in the navigation tree at the left panel. The properties of the selected 1010CB device are displayed.

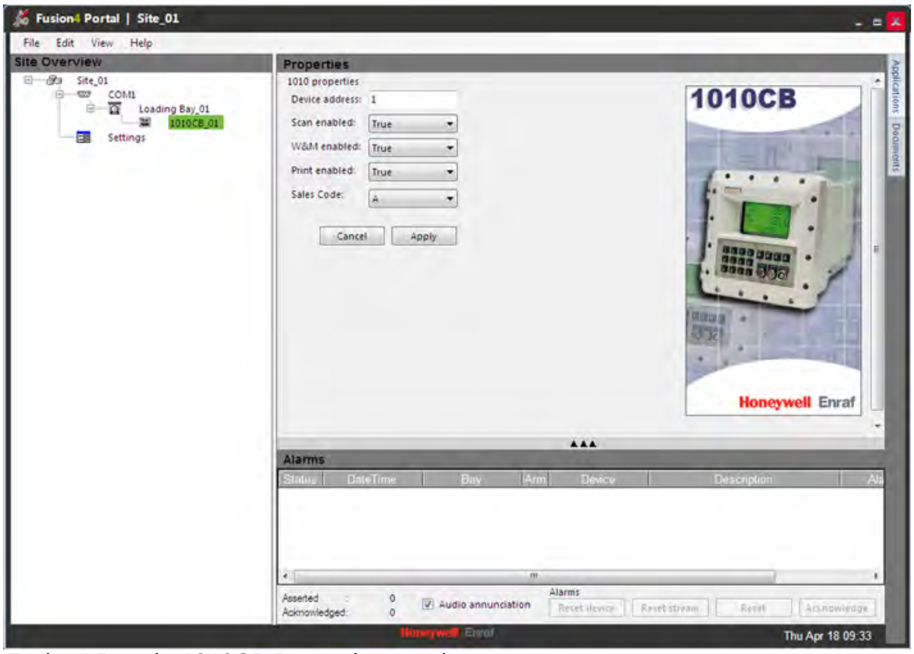

FIGURE 14-11 *Fusion4 Portal - 1010CB Properties* panel

3. Select the sales code from the selection list box. The sales codes are described in TABLE 14-3.

TABLE 14-3 1010CB Sales Codes

Sales Code	Description	OPC items available for
A	One arm loading with straight loading	Arm1 - [Base meter] Meter 1
B	One arm loading with ratio blending	Arm1 - [Base and Blend meter] Meter 1 Meter 2
C	One arm loading with side stream blending	Arm1 - [Base and Blend meter] Meter 1 Meter 2
D	Two arm loading with straight loading	Arm1 - [Base meter] Arm2 - [Base meter] Meter 1 Meter 2
E	Two arm loading: one straight loading and one with ratio blending	Arm 1 - [Base meter] Arm 2 - [Base and Blend meter] Meter 1 Meter 2 Meter 3
F	Two arm loading: one straight loading and one with side stream blending	Arm 1 - [Base meter] Arm 2 - [Base and Blend meter] Meter 1 Meter 2 Meter 3
G	Two arm loading each with ratio blending	Arm 1 - [Base and Blend meter] Arm 2 - [Base and Blend meter] Meter 1 Meter 2 Meter 3 Meter 4
H	Two arm loading each with side stream blending	Arm 1 - [Base and Blend meter] Arm 2 - [Base and Blend meter] Meter 1 Meter 2 Meter 3 Meter 4
J	Four arm loading with straight loading	Arm 1 - [Base meter] Arm 2 - [Base meter] Arm 3 - [Base meter] Arm 4 - [Base meter] Meter 1 Meter 2 Meter 3 Meter 4

14.1.9 Engineering Units

The engineering units of a device will be retrieved and updated in the OPC items listed in TABLE 14-4:

TABLE 14-4 Engineering Units for Device

OPC Item	Access	Data Type	Range	Description
[B].[D].EU.FetchEU	RW	VT_UI2	1	Command to fetch Engineering units (1 = Fetch)
[B].[D].EU.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].EU.A[n].MassUnit	R	VT_UI2		Mass units on loading arm n
[B].[D].EU.A[n].VolumeUnit	R	VT_UI2		Volume units on loading arm n
[B].[D].EU.AdditiveInjectionUnit	R	VT_UI2		Additive injection units
[B].[D].EU.LeakingSolenoidVolUnit	R	VT_UI2		Leak solenoid volume units
[B].[D].EU.M[n].DensityBreakDownUnit	R	VT_UI2		Density breakdown units for flow meter n
[B].[D].EU.M[n].DensityUnit	R	VT_UI2		Density units for flow meter n
[B].[D].EU.M[n].PressureUnit	R	VT_UI2		Density pressure units for flow meter n
[B].[D].EU.TemperatureUnit	R	VT_UI2		Temperature units

TAS/OPC client should convert the enumerated value to units as shown in TABLE 14-5.

TABLE 14-5 Conversion Table for Engineering Units

Entity	METRIC-ISO		US UNITS	
	Units	Enumerated Value	Units	Enumerated Value
Density Break Down	kg/m^3	60	RD60	63
Manual Density	kg/m^3	60	RD60	63
Analog Density	kg/m^3	60	lb/ft^3	62
Manual Pressure	kPa	32	PSIg	42
Analog Pressure	kPa	32	PSI	41
Temperature	°C	20	°F	21
Leaking Solenoid Volume	ml	257	cc	258

Entity	METRIC-ISO		US UNITS	
	Units	Enumerated Value	Units	Enumerated Value
Loading Arm Units (Volume)	L & L/min	50	Gal & Gal/min	52
	m^3 & m^3/h	51		
Loading Arm Units (Mass)	kg & kg/min	100	lb & lb/min	106
	t & t/h	101		
	g & g/min	105		
Additive Injection	ml	257	cc	258
Blend/Additive Recipes (Preset prompt for arm is Volume/Disabled)	PPM	259	PPM	259
Blend/Additive Recipes (Preset prompt for arm is Mass)	ml	257	cc	258

14.2 Communication

14.2.1 Checking TAS Status

You can find out the status of the TAS system by checking the OPC item listed in TABLE 14-6.

TABLE 14-6 OPC item for checking TAS status

OPC Item	Access Type	Data Type	Range	Description
Sys.TASStatus	R or RW	VT_UI2 or VT_BOOL		Represents the status of TAS connected to the Fusion4 OPC server

Value for Sys.TASStatus is set by TAS/ OPC client to instruct Fusion4 portal whether TAS/ OPC client is connected and in running state. The values depends on the TAS Status setting described in section 14.1.5.1. When the TAS Status setting is ‘Time Ticker’ the TAS status is checked every 10 seconds.

14.2.2 Checking Device Communications Status

You can find out the communications status of Fusion4 OPC server to a device by checking the OPC item listed in TABLE 14-7.

TABLE 14-7 OPC item for checking device communications status

OPC Item	Access Type	Data Type	Range	Description
[B].[D].CommSts	R	VT_UI2		Represents communications status of Fusion4 OPC server to device: 0 = Initial 1 = Good 2 = Bad, i.e. communications port is not properly connected to device, device is not good or cable failure/device not properly connected 3 = [B].[D].DeviceScanDisable is set to TRUE, i.e. device is manually over-ridden to killed state to stop scanning on device

14.2.2.1 Stopping and Restarting Scanning on Device

There may be situations where a device should not be scanned, e.g. the device is out of service due to maintenance. TAS/OPC client can kill the device by setting the value of the OPC item listed in TABLE 14-8 to TRUE.

TABLE 14-8 OPC Item enabling/disabling device scan

OPC Item	Access Type	Data Type	Range	Description
[B].[D].DeviceScanDisable	RW	VT_BOOL	TRUE or FALSE	Represents whether TAS/OPC has overridden device to killed state to stop scanning on the device: TRUE or FALSE.

Once the device has to be scanned again, the value of the OPC item needs to be set to FALSE.

14.2.3 Checking Health of Fusion4 OPC Server

You can monitor the health of Fusion4 OPC server by checking the following OPC item.

- Heartbeat

If the health of the Fusion4 OPC server is good the value of the OPC item is incremented every 5 seconds. If the value is not incremented then it is likely that the OPC server is not scanning the device.

14.2.4 Handshaking between Client and Fusion4 OPC Server

When TAS/OPC client issues a command to a device, Fusion4 OPC server stores the response of the device to the command as an OPC item with the following format:

- [B].[D].[Command].DevResp

The OPC item can have one of the values listed in TABLE 14-9.

TABLE 14-9 Possible values for [B].[D].[Command].DevResp

Value	Description
0	None, i.e. Fusion4 OPC server has not yet issued the command to the device.
1	Fusion4 OPC server received an ACK from the device, i.e. the device processed the command without any errors
2	Fusion4 OPC server received a NAK from the device, i.e. the device did not process the command due to one or more errors.
3	Fusion4 OPC server received a BUSY from the device.

Based on the value of DevResp the TAS/OPC client should take appropriate action to retry few times.

14.3 Loading Workflow Support for TAS System

14.3.1 About Loading Workflow Support

Typically, the Terminal Automation System (TAS) remotely controls and monitors the loading at the 1010CB device. Examples could be, TAS authorizes the vehicle whether it is eligible for the product at the bay, authorize the load quantity against the purchase order, monitor the flow rate when the fluid is being filled into the container OR to display a message at the device about non-availability of certain products. Fusion4 OPC server offers OPC items to support such workflow, subjected to appropriate settings achieved at the 1010CB device itself.

Fusion4 OPC server through various OPC items will constantly watch the loading status at the device and will notify TAS when actions are needed.

14.3.2 Example of Workflow

REMARK: The following workflow is subjected to the setting at the 1010CB device itself. Refer to the 1010CB Programming Manual and the 1010CB Protocol Manual for details on the setting.

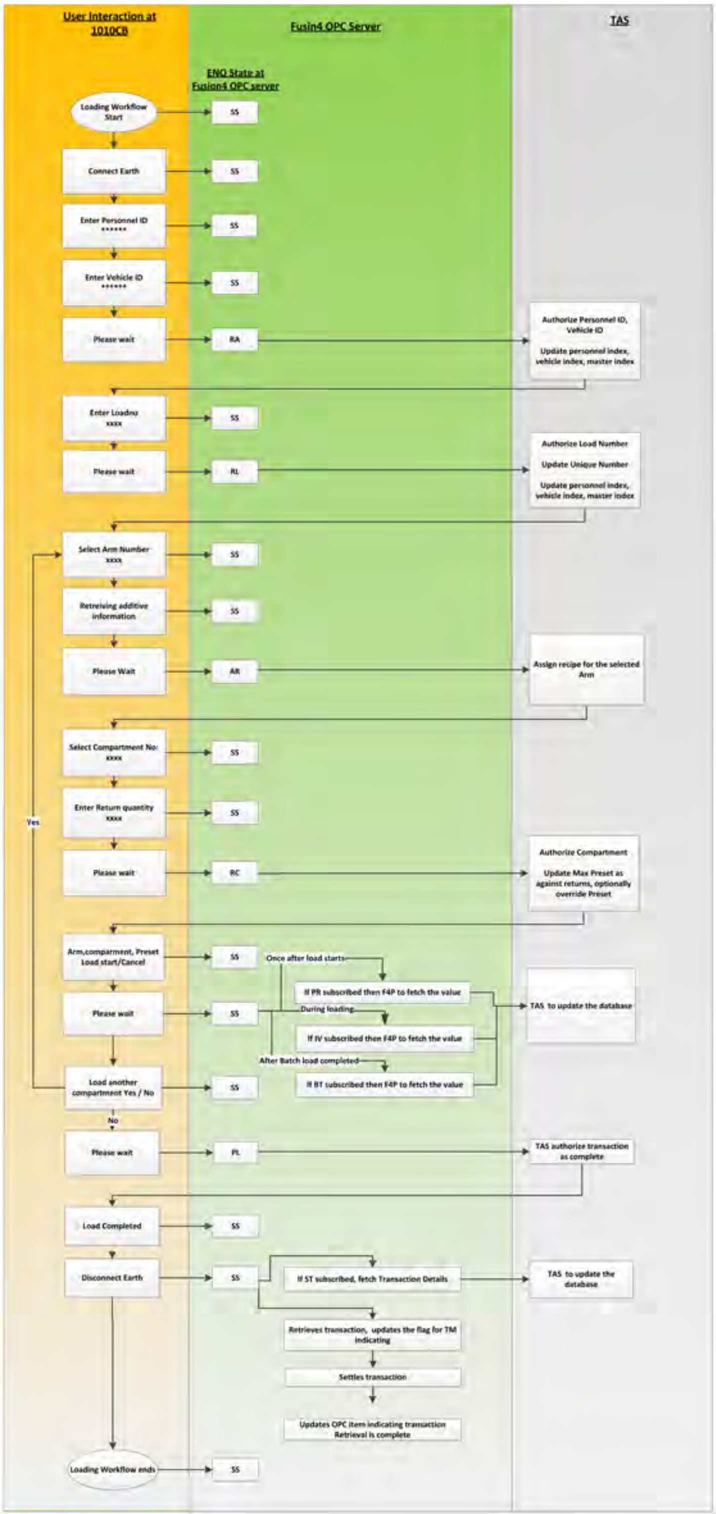

FIGURE 14-12 Workflow for Typical Loading a Site

14.3.3 Loading States - ENQ

TAS/ OPC client can determine the loading state at the device through the group of OPC items listed in TABLE 14-10.

TABLE 14-10 OPC items for determining loading state at device

OPC Item	Access Type	Data Type	Range	Description
[B].[D].ENQ.	R	VT_BSTR		ENQ status for the device.
[B].[D].ENQ.FirstArmNum	R	VT_UI2		First arm number
[B].[D].ENQ.Idle	R	VT_BOOL		Device idle status
[B].[D].ENQ.LastTransNum	R	VT_UI4		Last transaction number
[B].[D].ENQ.PowerFailureDetected	R	VT_BOOL		A power failure detect
[B].[D].ENQ.ProgrammableInputsConnected	R	VT_BOOL		Programmable inputs are connected
[B].[D].ENQ.ProgrammingDiagnosticMode	R	VT_BOOL		Programming/Hardware test/ Diagnostics mode is active
[B].[D].ENQ.TotalArms	R	VT_UI2		Total number of arms
[B].[D].ENQ.UnauthorisedFlowInProgress	R	VT_BOOL		Unauthorized flow is in progress on an arm
[B].[D].Sts.Alarm	R	VT_BOOL		Alarm Status 0 = Off 1 = On (i.e. there is alarm condition)
[B].[D].Sts.EOF	R	VT_BOOL		Earth / Overfill Input Status 0 = Off 1 = On
[B].[D].sts.MngrReset	R	VT_BOOL		Manager Reset Status 0 = Manager reset not required 1 = Manager reset required
[B].[D].Load.TransNum	R	VT_UI4		Current/last completed transaction. Incremented after passing ‘RA’ state.
[B].[D].Load.TransNumCompare	R	VT_I4		Current/ last retrieved transaction by Fusion4 Portal. Incremented after Fusion4 Portal retrieves data and prints (if print is enabled).
[B].[D].KA.TouchKeyNum	R	VT_BSTR		TouchKey number when ENQ state is ‘KA’
[B].[D].NA.NexWatchNum	R	VT_BSTR		NexWatch key number when ENQ state is ‘NA’
[B].[D].RIT.A1.Ack	R	VT_BOOL		RIT ack arm 1
[B].[D].RIT.A1.NotUsed	R	VT_BOOL		Not used
[B].[D].RIT.A1.Start	R	VT_BOOL		RIT start arm 1

OPC Item	Access Type	Data Type	Range	Description
[B].[D].RIT.A1.Stop	R	VT_BOOL		RIT stop arm 1
[B].[D].RIT.A2.Ack	R	VT_BOOL		RIT ack arm 2
[B].[D].RIT.A2.NotUsed	R	VT_BOOL		Not used
[B].[D].RIT.A2.Start	R	VT_BOOL		RIT start arm 2
[B].[D].RIT.A2.Stop	R	VT_BOOL		RIT stop arm 2

14.3.4 Remote Authorisation State - RA

The value “RA” at [B].[D].ENQ indicates Remote Authorisation state. At this state, Fusion4 OPC server provides the necessary information to TAS/ OPC Client that are required to authorise, like driver ID and vehicle ID. TAS/ OPC Client is required to authorise these details by writing into OPC items that have ReadWrite access (optionally) and then to [B].[D].RA.Response. Note that 1010CB will not proceed to further state until TAS/ OPC Client responds.

TABLE 14-11 lists the OPC items for the Remote Authorisation State.

TABLE 14-11 OPC Items for Remote Authorisation State

OPC Item	Access	Data Type	Range	Description
[B].[D].RA.PerID	R	VT_BSTR		Personnel ID entered at 1010CB.
[B].[D].RA.VehID	R	VT_BSTR		Vehicle ID entered at 1010CB.
[B].[D].RA.MastrID	R	VT_BSTR		Master ID entered at 1010CB.
[B].[D].RA.PerIndex	RW	VT_BSTR		Personnel Index entered at 1010CB. TAS/ OPC client can override after validating, but before writing to [B].[D].RA.Response.
[B].[D].RA.VehIndex	RW	VT_BSTR		Vehicle Index entered at 1010CB. TAS/ OPC client can override after validating, but before writing to [B].[D].RA.Response.
[B].[D].RA.MastrIndex	RW	VT_BSTR		Master Index entered at 1010CB. TAS/ OPC client can override after validating, but before writing to [B].[D].RA.Response.
[B].[D].RA.DenyMsg	RW	VT_BSTR	1 to 30	Text message to display on 1010CB when authorisation is denied (or an asterisk * to not display any message). The value to be set by TAS/ OPC client before writing to [B].[D].RA.Response.
[B].[D].RA.Response	RW	VT_UI2	0 to 2	The value to be set by TAS/OPC Client in response to the authorization request. The response is passed to 1010CB by Fusion4 OPC Server. Possible values are 0 = None, 1 = OK, 2 = denied.

OPC Item	Access	Data Type	Range	Description
[B].[D].RA.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.3.5 Remote Load Authorisation State - RL

The value “RL” at [B].[D].ENQ indicates Remote Load Authorisation state. At this state, Fusion4 OPC server provides the necessary information to TAS/ OPC Client that are required to authorise the load. TAS/ OPC Client is required to authorise these details by writing into OPC items that have ReadWrite access (optionally) and then to [B].[D].RL.Response. Note that 1010CB will not proceed to further state until TAS/ OPC Client responds.

TABLE 14-11 lists the OPC items for the Remote Load Authorisation State.

TABLE 14-12 OPC Items for Remote Load Authorisation State

OPC Item	Access	Data Type	Range	Description
[B].[D].RL.PerID	R	VT_BSTR		Personnel ID entered at 1010CB.
[B].[D].RL.VehID	R	VT_BSTR		Vehicle ID entered at 1010CB.
[B].[D].RL.MastrID	R	VT_BSTR		Master ID entered at 1010CB
[B].[D].RL.LoadNum	R	VT_BSTR		Load number entered at 1010CB.
[B].[D].RL.PerIndex	RW	VT_BSTR		Personnel Index entered at 1010CB. TAS/ OPC client can override after validating, but before writing to [B].[D].RL.Response.
[B].[D].RL.VehIndex	RW	VT_BSTR		Vehicle Index entered at 1010CB. TAS/ OPC client can override after validating, but before writing to [B].[D].RL.Response.
[B].[D].RL.MastrIndex	RW	VT_BSTR		Master Index entered at 1010CB. TAS/ OPC client can override after validating, but before writing to [B].[D].RL.Response.
[B].[D].RL.UniqueNum	RW	VT_UI4		TAS/ OPC Client can set a Unique Number (optional) to identify the load. This Unique Number when set by TAS/ OPC Client will appear on BOL at the place of Load Number. The write actions should be before writing to [B].[D].RL.Response.

OPC Item	Access	Data Type	Range	Description
[B].[D].RL.SkipFlag	RW	VT_BOOL		A boolean to prevent 1010CB to force "Disconnect Earth". This is optional. 1010CB will retry with Loading details when not specified with TRUE. The write actions should be before writing to [B].[D].RL.Response.
[B].[D].RL.DenyMsg	RW	VT_BSTR	1 to 30	Text message to display on 1010CB when authorisation is denied (or an asterisk * to not display any message). The value to be set by TAS/ OPC client before writing to [B].[D].RL.Response.
[B].[D].RL.Response	RW	VT_UI2	0 to 2	The value to be set by TAS/OPC Client in response to the authorization request. The response is passed to 1010CB by Fusion4 OPC Server. Possible values are 0 = None, 1 = OK, 2 = denied.
[B].[D].RL.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.3.6 Allocate Recipe State - AR

The value "AR" at [B].[D].ENQ indicates Allocate Recipe state. At this state, Fusion4 OPC server provides the necessary information to TAS/ OPC Client that are required to allocate a recipe. TAS/ OPC Client is required to authorise these details by writing suitable values to [B].[D].AR.WriteAR. Note that 1010CB will not proceed to further state until TAS/ OPC Client responds.

There are three options:

- Option 1 - Device uses a recipe stored in its own memory (see section 14.3.6.1)
- Option 2 - Device uses a recipe downloaded for the loading arm configured for additive and straight product loading (see section 14.3.6.2)
- Option 3 - Device uses a recipe downloaded for the loading arm configured for blending, with or without additive injection (see section 14.4.1.3)

14.3.6.1 Option 1

TABLE 14-13 lists the OPC items for the allocate recipe (AR) state, whereby the device uses a recipe stored in the its own memory.

TABLE 14-13 OPC items for AR state - Option 1

OPC Item	Access Type	Data Type	Range	Description
[B].[D].AR.ArmNum	R	VT_UI2		Loading arm number entered at 1010CB.
[B].[D].AR.RecipeAvailable	R	VT_BOOL		TRUE = Recipes available associated with this loading arm FALSE = No recipe available
[B].[D].AR.Index	RW	VT_UI2		Recipe index to use
[B].[D].AR.WriteAR	RW	VT_UI2	1	Write command flag (1 = Write)
[B].[D].AR.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.3.6.2 Option 2

TABLE 14-14 lists the OPC items for the allocate recipe (AR) state, whereby the device uses a recipe downloaded for the loading arm configured for additive and straight product loading.

TABLE 14-14 OPC items for AR state - Option 2

OPC Item	Access Type	Data Type	Range	Description
[B].[D].AR.ArmNumber	R	VT_UI2		Loading arm number
[B].[D].AR.RecipeAvailable	R	VT_BOOL		TRUE = Recipes available associated with this loading arm FALSE = No recipe available
[B].[D].AR.2.Line1Additive	RW	VT_R8		Line 1 additive amount
[B].[D].AR.2.Line2Additive	RW	VT_R8		Line 2 additive amount
[B].[D].AR.2.Line3Additive	RW	VT_R8		Line 3 additive amount
[B].[D].AR.2.Line4Additive	RW	VT_R8		Line 4 additive amount
[B].[D].AR.2.Line5Additive	RW	VT_R8		Line 5 additive amount
[B].[D].AR.2.Line6Additive	RW	VT_R8		Line 6 additive amount
[B].[D].AR.2.AdditiveFlushVol	RW	VT_R8		Additive flush volume
[B].[D].AR.2.WriteAR	RW	VT_UI2	1	Write command flag (1 = Write)

OPC Item	Access Type	Data Type	Range	Description
[B].[D].AR.2.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.3.6.3 Option 3

TABLE 14-15 lists the OPC items for the allocate recipe (AR) state, whereby the device uses a recipe downloaded for the arm configured for blending, with or without additive injection.

TABLE 14-15 OPC items for AR state - Option 3

OPC Item	Access	Data Type	Range	Description
[B].[D].AR.ArmNumber	R	VT_UI2		Loading arm number
[B].[D].AR.RecipeAvailable	R	VT_BOOL		TRUE = Recipes available associated with this loading arm FALSE = No recipe available
[B].[D].AR.3.Line1Additive	RW	VT_R8		Line 1 additive amount
[B].[D].AR.3.Line2Additive	RW	VT_R8		Line 2 additive amount
[B].[D].AR.3.Line3Additive	RW	VT_R8		Line 3 additive amount
[B].[D].AR.3.Line4Additive	RW	VT_R8		Line 4 additive amount
[B].[D].AR.3.Line5Additive	RW	VT_R8		Line 5 additive amount
[B].[D].AR.3.Line6Additive	RW	VT_R8		Line 6 additive amount
[B].[D].AR.3.AdditiveFlushVol	RW	VT_R8		Additive flush volume
[B].[D].AR.3.TargetBlendPerc	RW	VT_R8		Target blend percentage
[B].[D].AR.3.CleanLineVol	RW	VT_R8		Clean line volume
[B].[D].AR.3.WriteAR	RW	VT_UI2	1	Write command flag (1 = Write)
[B].[D].AR.3.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].AR.3.AllocArm	R	VT_UI2		Associated loading arm
[B].[D].AR.3.Status	R	VT_UI2		Recipe status: 0 = Disabled 1 = Enabled
[B].[D].AR.3.MinPreset	R	VT_R4		Calculated recipe minimum preset
[B].[D].AR.3.BaseHighFlow	R	VT_R4		Base calculated high flow

OPC Item	Access	Data Type	Range	Description
[B].[D].AR.3.BaseLowFlow	R	VT_R4		Base calculated low flow
[B].[D].AR.3.BaseSlowFlow	R	VT_R4		Base calculated slow flow
[B].[D].AR.3.BlendHighFlow	R	VT_R4		Blend calculated high flow
[B].[D].AR.3.BlendLowFlow	R	VT_R4		Blend calculated low flow
[B].[D].AR.3.BlendSlowFlow	R	VT_R4		Blend calculated slow flow
[B].[D].AR.3.Error	R	VT_UI2		Recipe error code

14.3.7 Remote Compartment Authorisation State - RC

The value "RC" at [B].[D].ENQ indicates Remote Compartment Authorisation (RC) state. At this state, Fusion4 OPC server provides the necessary information to TAS/ OPC Client that are required to authorise the compartment. TAS/ OPC Client is required to authorise these details by writing into OPC items that have ReadWrite access (optionally) and then to [B].[D].RC.Response. Note that 1010CB will not proceed to further state until TAS/ OPC Client responds.

TABLE 14-16 lists the OPC items for the RC state.

TABLE 14-16 OPC Items for RC State

OPC Item	Access	Data Type	Range	Description
[B].[D].RC.LoadNum	R	VT_BSTR		Load Number entered at 1010CB device
[B].[D].RC.ReqArm	R	VT_UI2		Loading arm number entered at 1010CB device
[B].[D].RC.ReqComp	R	VT_UI2		Compartment number entered at 1010CB device
[B].[D].RC.Return	R	VT_R4		Return quantity entered at 1010CB device
[B].[D].RC.Preset	RW	VT_R4		Preset for selected compartment
[B].[D].RC.MaxPreset	RW	VT_R4		Maximum preset for selected compartment
[B].[D].RC.RetryParam	RW	VT_UI2		0 = Retry allowed, 1 = Force load completion
[B].[D].RC.SkipPrompt	RW	VT_BOOL		Skip preset prompt S
[B].[D].RC.DenyMsg	RW	VT_BSTR	1 to 30	Text message to display on 1010CB when authorisation is denied (or an asterisk * to not display any message). The value to be set by TAS/ OPC client before writing to [B].[D].RC.Response.

OPC Item	Access	Data Type	Range	Description
[B].[D].RC.Response	RW	VT_UI2	0 to 2	The value to be set by TAS/OPC Client in response to the authorization request. The response is passed to 1010CB by Fusion4 OPC Server. Possible values are: 0 = None 1 = OK 2 = denied.
[B].[D].RC.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.3.8 Batch Loading State - IV

The IV command enables TAS/OPC Client to fetch the loading arm where loading is in progress. The values for the OPC items are retrieved from the device through instantaneous value.

TABLE 14-17 lists the OPC items for the IV command.

TABLE 14-17 OPC items for IV command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].A[n].FetchIV	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].A[n].IV.DevResp	R	VT_UI2		Device reply to SLIP IV command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].A[n].BatchError	R	VT_UI2		Loading batch error
[B].[D].A[n].BatchPaused	R	VT_UI2		Loading paused: 0 = None 1 = Paused
[B].[D].A[n].BatchProgress	R	VT_UI2		Loading in progress 0 = None 1 = In progress
[B].[D].A[n].FlowRate	R	VT_R4		Loading arm flow rate
[B].[D].A[n].GOV	R	VT_R4		Loading Gross (Natural) Volume through loading arm
[B].[D].A[n].GOVacc	R	VT_R8		Accumulative Total Gross (Natural) Volume through loading arm
[B].[D].A[n].GSV	R	VT_R4		Loading Standard Volume through loading arm

OPC Item	Access Type	Data Type	Range	Description
[B].[D].A[n].GSVacc	R	VT_R8		Accumulative Total Standard Volume through loading arm
[B].[D].A[n].M1.FlowRate	R	VT_R4		Product meter flow rate
[B].[D].A[n].M1.GOV	R	VT_R4		Loading Gross (Natural) Volume through product meter
[B].[D].A[n].M1.GOVacc	R	VT_R8		Accumulative Total Gross (Natural) Volume through product meter
[B].[D].A[n].M1.GSV	R	VT_R4		Loading Standard Volume through product meter
[B].[D].A[n].M1.GSVacc	R	VT_R8		Accumulative Total Standard Volume through product meter
[B].[D].A[n].M1.Press	R	VT_R4		Product stream pressure
[B].[D].A[n].M1.RefDensity	R	VT_R4		Product stream density
[B].[D].A[n].M1.Temp	R	VT_R4		Product stream temperature
[B].[D].A[n].M2.FlowRate	R	VT_R4		Product meter flow rate
[B].[D].A[n].M2.GOV	R	VT_R4		Loading Gross (Natural) Volume through product meter
[B].[D].A[n].M2.GOVacc	R	VT_R8		Accumulative Total Gross (Natural) Volume through product meter
[B].[D].A[n].M2.GSV	R	VT_R4		Loading Standard Volume through product meter
[B].[D].A[n].M2.GSVacc	R	VT_R8		Accumulative Total Standard Volume through product meter
[B].[D].A[n].M2.Press	R	VT_R4		Product stream pressure
[B].[D].A[n].M2.RefDensity	R	VT_R4		Product stream density
[B].[D].A[n].M2.Temp	R	VT_R4		Product stream temperature

14.3.9 Batch Loading Completed - BT

The BT command enables TAS/OPC Client to the loading arm where batch loading is completed.

TABLE 14-18 lists the OPC items for batch loading completed.

REMARK: In the OPC items listed in TABLE 14-18 [n] indicates the number of the loading arm and can be 1 to 4.

TABLE 14-18 OPC items for batch loading completed

OPC Item	Access Type	Data Type	Range	Description
[B].[D].A[n].FetchBT	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].A[n].BTDevResp	R			Device reply to SLIP BT command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].A[n].Load.BatchComplete	R	VT_UI2		Load complete status from 1010CB on the arm: 0 = None 1 = Complete
[B].[D].A[n].Load.BatchNo	R	VT_UI2		Batch number
[B].[D].A[n].Load.BlendAcy	R	VT_UI2		Blend accuracy
[B].[D].A[n].Load.BlendType	R	VT_UI2		Blend type
[B].[D].A[n].Load.CheckSum	R	VT_BSTR		Checksum result
[B].[D].A[n].Load.CompNo	R	VT_UI2		Compartment number
[B].[D].A[n].Load.Error	R	VT_BSTR		Error status
[B].[D].A[n].Load.PresetQty	R	VT_R4		Preset quantity
[B].[D].A[n].Load.RecipeID	R	VT_UI2		Recipe number
[B].[D].A[n].Load.ReturnQty	R	VT_R4		Return quantity
[B].[D].A[n].Load.StartTime	R	VT_BSTR		Batch start time (hhmmss) (24 hours format)
[B].[D].A[n].Load.StopTime	R	VT_BSTR		Batch stop time (hhmmss) (24 hours format)
[B].[D].A[n].Load.TransNo	R	VT_UI4		Transaction number
[B].[D].A[n].Load.Units	R	VT_BSTR		Loading units
[B].[D].A[n].LoadAdditive.BatchNo	R	VT_UI2		Batch number
[B].[D].A[n].LoadAdditive.Quantity1	R	VT_R4		Injected additive 1 quantity
[B].[D].A[n].LoadAdditive.Quantity2	R	VT_R4		Injected additive 2 quantity
[B].[D].A[n].LoadAdditive.Quantity3	R	VT_R4		Injected additive 3 quantity
[B].[D].A[n].LoadAdditive.Quantity4	R	VT_R4		Injected additive 4 quantity
[B].[D].A[n].LoadAdditive.Quantity5	R	VT_R4		Injected additive 5 quantity
[B].[D].A[n].LoadAdditive.Quantity6	R	VT_R4		Injected additive 6 quantity
[B].[D].A[n].LoadAdditive.TransNo	R	VT_UI4		Transaction number
[B].[D].A[n].LoadBase.BatchNo	R	VT_UI2		Batch number
[B].[D].A[n].LoadBase.CheckSum	R	VT_BSTR		Checksum results
[B].[D].A[n].LoadBase.Commodity	R	VT_UI2		Commodity

OPC Item	Access Type	Data Type	Range	Description
[B].[D].A[n].LoadBase.DensFWA	R	VT_R4		Product meter calculated density at meter flow weighted average
[B].[D].A[n].LoadBase.Error	R	VT_BSTR		Error status
[B].[D].A[n].LoadBase.ExpFactor	R	VT_R4		Product meter expansion co-efficient
[B].[D].A[n].LoadBase.GOV	R	VT_R4		Loaded Gross Observed Volume through product meter
[B].[D].A[n].LoadBase.GOVaccAft	R	VT_R8		Product meter accumulative total Gross Observed Volume before batch
[B].[D].A[n].LoadBase.GOVaccBef	R	VT_R8		Product meter accumulative total Gross Observed Volume after batch
[B].[D].A[n].LoadBase.GSV	R	VT_R4		Loaded Gross Standard Volume through product meter
[B].[D].A[n].LoadBase.GSVaccAft	R	VT_R8		Product meter accumulative total Gross Standard Volume before batch
[B].[D].A[n].LoadBase.GSVaccBef	R	VT_R8		Product meter accumulative total Gross Standard Volume after batch
[B].[D].A[n].LoadBase.MeterNo	R	VT_UI2		Base meter number
[B].[D].A[n].LoadBase.Preset	R	VT_R4		Product meter preset quantity calculated after load authorisation
[B].[D].A[n].LoadBase.PressFWA	R	VT_R4		Product meter batch pressure flow weighted average
[B].[D].A[n].LoadBase.ProdDensObs	R	VT_R4		Product meter product observed density
[B].[D].A[n].LoadBase.TempFWA	R	VT_R4		Product meter batch temperature flow weighted average
[B].[D].A[n].LoadBase.TransNo	R	VT_UI4		Transaction number
[B].[D].A[n].LoadBlend.BatchNo	R	VT_UI2		Batch number
[B].[D].A[n].LoadBlend.CheckSum	R	VT_BSTR		Checksum results
[B].[D].A[n].LoadBlend.Commodity	R	VT_UI2		Commodity
[B].[D].A[n].LoadBlend.DensFWA	R	VT_R4		Blend meter calculated density at meter flow weighted average
[B].[D].A[n].LoadBlend.Error	R	VT_BSTR		Error status
[B].[D].A[n].LoadBlend.ExpFactor	R	VT_R4		Product meter expansion co-efficient
[B].[D].A[n].LoadBlend.GOV	R	VT_R4		Loaded Gross Observed Volume through blend meter
[B].[D].A[n].LoadBlend.GOVaccAft	R	VT_R8		Blend meter accumulative total Gross Observed Volume after batch
[B].[D].A[n].LoadBlend.GOVaccBef	R	VT_R8		Blend meter accumulative total Gross Observed Volume before batch
[B].[D].A[n].LoadBlend.GSV	R	VT_R4		Loaded Gross Standard Volume through blend meter

OPC Item	Access Type	Data Type	Range	Description
[B].[D].A[n].LoadBlend.GSVaccAft	R	VT_R8		Blend meter accumulative total Gross Standard Volume after batch
[B].[D].A[n].LoadBlend.GSVaccBef	R	VT_R8		Blend meter accumulative total Gross Standard Volume before batch
[B].[D].A[n].LoadBlend.MeterNo	R	VT_UI2		Blend meter number
[B].[D].A[n].LoadBlend.Preset	R	VT_R4		Blend meter preset quantity calculated after load authorisation
[B].[D].A[n.LoadBlend.PressFWA	R	VT_R4		Blend meter batch flow weighted average
[B].[D].A[n].LoadBlend.ProdDensObs	R	VT_R4		Blend meter product observed density
[B].[D].A[n].LoadBlend.TempFWA	R	VT_R4		Blend meter batch flow weighted average
[B].[D].A[n].LoadBlend.TransNo	R	VT_UI4		Transaction number
[B].[D].A[n].BatchTotalComplete	R	VT_UI12		Indicates Fusion4 has completed retrieving all information about the current batch completed: 0 = None 1 = Complete

14.3.10 Authorizing Transaction Complete from TAS/ OPC client

Fusion4 OPC server offers a handshaking mechanism to wait until TAS/ OPC Client authorizes the transaction as complete before allowing 1010CB to proceed further. This is to ensure TAS/ OPC Client has got all the data required for the transaction and before the next one.

The value “PL” at [B].[D].ENQ indicates Post Loading ENQ state. TAS/ OPC Client is required to authorize transaction as complete by writing “1” on [B].[D].Load.TransCompete. After successful write, ENQ state will pass “PL” state and move to “ss” state

TABLE 14-19 lists the OPC Items for the PL state.

TABLE 14-19 OPC items for Post Loading (PL) state

OPC Item	Access Type	Data Type	Range	Description
[B].[D].Load.TransComplete	RW	VT_UI2	1	Flag for TM to set when PL state (Transaction Complete): 0 = Unset, 1 = TC
[B].[D].Load.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.3.11 Settling Transaction- TS

TAS/OPC Client can settle a transaction so that it can be overwritten by a new transaction every 292 transactions. If a transaction is not settled, when the next transaction number is equal to this unsettled transaction position in memory, no further loading can be performed until it is settled. By settling the transaction you are indicating that the transaction information no longer needs to be stored in the instrument memory.

REMARK: this step is required only when the license has “N” at pos 5 (No BoL Printing).

TABLE 14-20 lists the OPC Items for transaction settling.

TABLE 14-20 OPC items for settling transaction (TS)

OPC Item	Access Type	Data Type	Range	Description
[B].[D].TS.TransNum	RW	VT_UI2		Transaction number
[B].[D].TS.WriteTS	R	VT_UI2	1	Write command flag (1 = Write)
[B].[D].TS.DevResp				Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].TS.TransStatus				Transaction status: 0 = Transaction settled successfully 1 = Transaction in progress/ Valves not closed 2 = Transaction not found

14.4 TAS/OPC Client Commands

14.4.1 Internal Additive Injectors - AD

TAS/OPC client can retrieve the internal additive injector settings of the device by issuing the AD command.

There are three options:

- Option 1 - Retrieving the internal additive injection type and the number of injection points (see section 14.4.1.1)
- Option 2 Retrieving the specific internal additive injector settings for the device (see section 14.4.1.2)
- Option 3 Retrieving the specific internal additive injector settings for the device (see section 14.4.1.3)

14.4.1.1 Option 1

TABLE 14-21 lists the OPC items for the AD command for retrieving the internal additive injection type and number of injection points.

TABLE 14-21 OPC items for AD command - Option 1

OPC Item	Access Type	Data Type	Range	Description
[B].[D].AD.1.FetchAD	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].AD.1.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].AD.1.InternalAdditiveInjector1.AllocatedArm	R	VT_UI2		Internal additive injection allocated arm
[B].[D].AD.1.InternalAdditiveInjector1.Type	R	VT_UI2		Internal additive injection type
[B].[D].AD.1.InternalAdditiveInjector2.AllocatedArm	R	VT_UI2		Internal additive injection allocated arm
[B].[D].AD.1.InternalAdditiveInjector2.Type	R	VT_UI2		Internal additive injection type
[B].[D].AD.1.InternalAdditiveInjector3.AllocatedArm	R	VT_UI2		Internal additive injection allocated arm
[B].[D].AD.1.InternalAdditiveInjector3.Type	R	VT_UI2		Internal additive injection type
[B].[D].AD.1.InternalAdditiveInjector4.AllocatedArm	R	VT_UI2		Internal additive injection allocated arm
[B].[D].AD.1.InternalAdditiveInjector4.Type	R	VT_UI2		Internal additive injection type
[B].[D].AD.1.InternalAdditiveInjector5.AllocatedArm	R	VT_UI2		Internal additive injection allocated arm
[B].[D].AD.1.InternalAdditiveInjector5.Type	R	VT_UI2		Internal additive injection type
[B].[D].AD.1.InternalAdditiveInjector6.AllocatedArm	R	VT_UI2		Internal additive injection allocated arm
[B].[D].AD.1.InternalAdditiveInjector6.Type	R	VT_UI2		Internal additive injection type

14.4.1.2 Option 2

TABLE 14-22 lists the OPC items for the AD command for retrieving the internal additive injection type and number of injection points.

TABLE 14-22 OPC items for AD command - Option 2

OPC Item	Access Type	Data Type	Range	Description
[B].[D].AD.2.InternalAdditiveInjectorNum	RW	VT_UI2		Injector number
[B].[D].AD.2.FetchAD	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].AD.2.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].AD.2.InternalAdditiveDeviationAlm	R	VT_BSTR		Additive deviation alarm enabled
[B].[D].AD.2.InternalAdditiveDeviationInjectionCycle	R	VT_UI2		Additive deviation basis injection cycles
[B].[D].AD.2.InternalAdditiveDeviationVolPerc	R	VT_R4		Additive volume deviation [xxx] percentage
[B].[D].AD.2.LeakingSolenoidAlmEnabled	R	VT_BSTR		Leaking solenoid alarm enabled
[B].[D].AD.2.LeakingSolenoidTimePeriod	R	VT_UI2		Leaking solenoid time period
[B].[D].AD.2.LeakingSolenoidVolume	R	VT_R4		Leaking solenoid volume limit
[B].[D].AD.2.NoAdditiveFlowTimeOut	R	VT_UI2		No additive flow timeout in seconds
[B].[D].AD.2.NoAdditiveFlowTimeOutAlm	R	VT_BSTR		No additive flow timeout alarm enabled
[B].[D].AD.2.SolenoidNoOfRetries	R	VT_UI2		Number of solenoid retries [x]

14.4.1.3 Option 3

TABLE 14-23 lists the OPC items for the AD command for retrieving the internal additive injection type and number of injection points.

TABLE 14-23 OPC items for AD command - Option 3

OPC Item	Access Type	Data Type	Range	Description
[B].[D].AD.3.InternalAdditiveInjectorNum	RW	VT_UI2		Injector number
[B].[D].AD.3.FetchAD	RW	VT_UI2	1	Fetch command flag (1 =Fetch)
[B].[D].AD.3.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].AD.3.ArmNum	R	VT_UI2		Allocated arm number
[B].[D].AD.3.InternalAdditiveInjectorCode	R	VT_BSTR		Additive injector code
[B].[D].AD.3.InternalAdditiveInjectorPositionEnabled	R	VT_UI2		Injector position enabled
[B].[D].AD.3.InternalAdditiveMeterFactor	R	VT_R4		Additive meter factor
[B].[D].AD.3.InternalAdditiveMeterKfactor	R	VT_R4		Additive meter K-factor
[B].[D].AD.3.InternalAdditivePacingVolume	R	VT_R4		Pacing volume
[B].[D].AD.3.InternalAdditivePumpOffDelay	R	VT_R4		Pump off delay in seconds

14.4.2 External Additive Injectors - AI

TAS/OPC client can retrieve the external additive injector settings for the device by issuing the AI command to the device.

There are two options:

- Option 1 - Retrieving the external additive injection type and the number of injection points (see section 14.4.2.1).
- Option 2 - Retrieving the specific external additive injector settings of the device (see section 14.4.2.2).

14.4.2.1 Type and Number of Injection Points

TABLE 14-24 OPC items for AI command - Option 1

OPC Item	Access Type	Data Type	Length	Description
[B].[D].AI.1.FetchAI	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].AI.1.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].AI.1.ExternalAdditiveInjectionNoOfPoints	R	VT_UI2		Number of Injection points
[B].[D].AI.1.ExternalAdditiveInjectorType	R	VT_UI2		Additive injection type
[B].[D].AI.1.ExternalAdditivePulseWidth	R	VT_R4		Pulse width

14.4.2.2 Specific External Additive Injector Settings

TABLE 14-25 OPC Items for AI Command - Option 2

OPC Item	Access Type	Data Type	Range	Description
[B].[D].AI.2.ExternalAdditiveInjectorNum	RW	VT_UI2		Injector number (Range is 1 to 24)
[B].[D].AI.2.FetchAI	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].AI.2.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].AI.2.ExternalAdditiveAllocatedArmNum	R	VT_UI2		Allocated arm
[B].[D].AI.2.ExternalAdditiveInjectionPointAddress	R	VT_BSTR		Address of injection point
[B].[D].AI.2.ExternalAdditiveInjectorCode	R	VT_BSTR		Additive injector code

14.4.3 Arm Status - AM

TAS/OPC client can retrieve the status of a specific loading arm by issuing the AM command.

TABLE 14-26 lists the OPC items for the AM command.

REMARK: In the OPC items listed in TABLE 14-26 [n] indicates the loading arm number and can be 1 to 4.

TABLE 14-26 OPC items for AM command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].AM.[n].FetchAM	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].AM.[n].DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].AM.[n].ArmNum	R	VT_UI2		Arm number
[B].[D].AM.[n].ArmErrStatus	R	VT_UI2		Arm error status
[B].[D].AM.[n].ArmInterruptStatus	R	VT_UI2		Arm Interrupt/Pause status
[B].[D].AM.[n].ArmStatus	R	VT_UI2		Arm status (1 = Enabled 2 = Disabled 3 = Faulty)
[B].[D].AM.[n].M1ErrStatus	R	VT_UI2		Straight meter error status
[B].[D].AM.[n].M2ErrStatus	R	VT_UI2		Blend meter error status
[B].[D].AM.[n].SysInterruptStatus	R	VT_UI2		System Interrupt/Pause status

14.4.4 Arm Settings - AS

TAS/OPC client can retrieve the setup information unique to each loading arm by issuing the AS command.

There are two options:

- Option 1 (see section 14.4.4.1)
- Option 2 (see section 14.4.4.2)

14.4.4.1 Option 1

TABLE 14-27 lists the OPC items for the AS command - Option 1.

REMARK: In the OPC items listed in TABLE 14-27 [n] indicates the loading arm number and can be 1 to 4.

TABLE 14-27 OPC items for AS command - Option 1

OPC Item	Access Type	Data Type	Range	Description
[B].[D].AS.1.A[n].FetchAS	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].AS.1.A[n].DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].AS.1.A[n].ArmName	R	VT_BSTR		Loading arm name
[B].[D].AS.1.A[n].ArmNum	R	VT_UI2		Loading arm number
[B].[D].AS.1.A[n].ArmStatus	R	VT_UI2		Loading arm status (1 = Enabled, 2 = Disabled, 3 = Faulty)
[B].[D].AS.1.A[n].ArmType		VT_UI2		Loading arm type
[B].[D].AS.1.A[n].BaseMeterNum	R	VT_UI2		Straight meter number
[B].[D].AS.1.A[n].BlendMeterNum	R	VT_UI2		Blend meter number
[B].[D].AS.1.A[n].FullFlow	R	VT_R4		Loading arm full flow
[B].[D].AS.1.A[n].LoadUnits	R	VT_UI2		Load units: 0 = litres/liters 1 = m^3, 2 = kg 3 = tonnes 4 = grams 5 = gallons 6 = pounds)
[B].[D].AS.1.A[n].MaxPreset	R	VT_R4		Maximum preset
[B].[D].AS.1.A[n].SlowFlow	R	VT_R4		Loading arm slow flow
[B].[D].AS.1.A[n].SlowStartQty	R	VT_R4		Slow start quantity

14.4.4.2 Option 2

TABLE 14-28 lists the OPC items for the AS command - Option 2.

TABLE 14-28 OPC items for AS command - Option 2

OPC Item	Access Type	Data Type	Range	Description
[B].[D].AS.2.A1.FetchAS	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].AS.2.A1.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].AS.2.A1.ArmNum	R	VT_UI2		Loading arm number

OPC Item	Access Type	Data Type	Range	Description
[B].[D].AS.2.A1.BlendToleranceAlm	R	VT_UI2		Blend tolerance alarm (0 = DISABLE, 1 = ENABLE)
[B].[D].AS.2.A1.BlendToleranceHighPerc	R	VT_R4		Blend tolerance high percentage
[B].[D].AS.2.A1.BlendToleranceLowPerc	R	VT_R4		Blend tolerance low percentage
[B].[D].AS.2.A1.HighFlowAlm	R	VT_UI2		High flow alarm: 0 = DISABLE 1 = ENABLE)
[B].[D].AS.2.A1.HighFlowAlmDelay	R	VT_BSTR		High flow alarm delay
[B].[D].AS.2.A1.HighFlowHighPerc	R	VT_R4		High flow high percentage
[B].[D].AS.2.A1.HighFlowLowPerc	R	VT_R4		High flow low percentage
[B].[D].AS.2.A1.LowFlowAlm	R	VT_UI2		Low flow alarm (0 = DISABLE, 1 = ENABLE)
[B].[D].AS.2.A1.LowFlowAlmDelay	R	VT_BSTR		Low flow alarm delay
[B].[D].AS.2.A1.LowFlowHighPerc	R	VT_R4		Low flow high percentage
[B].[D].AS.2.A1.LowFlowLowPerc	R	VT_R4		Low flow low percentage
[B].[D].AS.2.A1.MinBlendVol	R	VT_R4		Minimum blend volume
[B].[D].AS.2.A1.SlowFlowAlm	R	VT_UI2		Slow flow alarm (0 = DISABLE, 1 = ENABLE)
[B].[D].AS.2.A1.SlowFlowAlmDelay	R	VT_BSTR		Slow flow alarm delay
[B].[D].AS.2.A1.SlowFlowHighPerc	R	VT_R4		Slow flow high percentage
[B].[D].AS.2.A1.SlowFlowLowPerc	R	VT_R4		Slow flow low percentage

14.4.5 Application Version - AV

TAS/OPC client can retrieve the application version, date and time from the device by issuing the AV command.

REMARK: The AV command can only be used while the device is in the idle state.

TABLE 14-29 lists the OPC items for the AV command.

TABLE 14-29 OPC items for AV command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].AV.FetchAV	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].AV.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

OPC Item	Access Type	Data Type	Range	Description
[B].[D].AV.Date	R	VT_BSTR		Date [mm:dd:yyyy]
[B].[D].AV.DisplayType	R	VT_BSTR		Display type
[B].[D].AV.FlashROMSize	R	VT_UI4		FLASH ROM size
[B].[D].AV.InstrumentModel	R	VT_BSTR		Device model and application pack
[B].[D].AV.ROMType	R	VT_BSTR		ROM type
[B].[D].AV.SoftwareCard	R	VT_BSTR		Software version and card selection
[B].[D].AV.SoftwareVersion	R	VT_BSTR		Software version
[B].[D].AV.Time	R	VT_BSTR		Time [hh:mm:ss]

14.4.6 Blend/Additive Recipes - BR

TAS/OPC client can upload blend/additive recipes to the computer or to download blend/additive recipes to the device by issuing the BR command. These recipes contain both blend and additive components. They apply when either blending two products or when using intelligent additive injection (Honeywell Enraf Mini-Pak additive injection system), or when blending two products and using intelligent additive injection.

There are two options:

- Option 1 - Uploading additive/blend recipe to the computer (see section 14.4.6.1)
- Option 2 - Downloading Additive/Blend Recipe to Device (see section 14.4.6.2)

REMARK: The BR command can only be used while the device is in the idle state.

14.4.6.1 Option 1 - Uploading Additive/Blend Recipe to Computer

TABLE 14-30 lists the OPC items for the BR command, where an additive/blend recipe is uploaded to the computer.

TABLE 14-30 OPC items for BR command - Option 1

OPC Item	Access Type	Data Type	Range	Description
[B].[D].BR.Upload.RecipeNumber	RW	VT_UI2		Recipe number (Range is 0 to 16)
[B].[D].BR.Upload.WriteBR	RW	VT_UI2	1	Write command flag (1 = Write)
[B].[D].BR.Upload.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].BR.Upload.AdditiveFlushVol	R	VT_R4		Additive flush volume

OPC Item	Access Type	Data Type	Range	Description
[B].[D].BR.Upload.ArmNum	R	VT_UI2		Number of the arm associated with recipe
[B].[D].BR.Upload.BaseHighFlow	R	VT_R4		Base calculated high flow
[B].[D].BR.Upload.BaseLowFlow	R	VT_R4		Base calculated low flow
[B].[D].BR.Upload.BaseSlowFlow	R	VT_R4		Base calculated slow flow
[B].[D].BR.Upload.BlendHighFlow	R	VT_R4		Blend calculated high flow
[B].[D].BR.Upload.BlendLowFlow	R	VT_R4		Blend calculated low flow
[B].[D].BR.Upload.BlendSlowFlow	R	VT_R4		Blend calculated slow flow
[B].[D].BR.Upload.CleanLineVol	R	VT_R4		Clean line volume
[B].[D].BR.Upload.Line1AdditiveAmount	R	VT_R4		Line 1 additive amount
[B].[D].BR.Upload.Line2AdditiveAmount	R	VT_R4		Line 2 additive amount
[B].[D].BR.Upload.Line3AdditiveAmount	R	VT_R4		Line 3 additive amount
[B].[D].BR.Upload.Line4AdditiveAmount	R	VT_R4		Line 4 additive amount
[B].[D].BR.Upload.Line5AdditiveAmount	R	VT_R4		Line 5 additive amount
[B].[D].BR.Upload.Line6AdditiveAmount	R	VT_R4		Line 6 additive amount
[B].[D].BR.Upload.RecipeMinimumPreset	R	VT_R4		Calculated recipe minimum preset
[B].[D].BR.Upload.RecipeName	R	VT_BSTR		Recipe name
[B].[D].BR.Upload.RecipeStatus	R	VT_UI2		Recipe status (0 = DISABLED, 1 = ENABLED)
[B].[D].BR.Upload.TargetBlendPerc	R	VT_R4		Target blend percentage

14.4.6.2 Option 2 - Downloading Additive/Blend Recipe to Device

TABLE 14-31 lists the OPC items for the BR command, where an additive/blend recipe is downloaded to the device.

TABLE 14-31 OPC items for BR Command - Option 2

OPC Item	Access Type	Data Type	Range	Description
[B].[D].BR.Download.RecipeNum	RW	VT_UI2		Number of recipe to be downloaded
[B].[D].BR.Download.RecipeStatus	RW	VT_UI2		Recipe status (0 = DISABLED, 1 = ENABLED)
[B].[D].BR.Download.RecipeName	RW	VT_BSTR		Recipe name
[B].[D].BR.Download.ArmNum	RW	VT_UI2		Number of arm to be associated with recipe
[B].[D].BR.Download.TargetBlendPerc	RW	VT_R4		Target blend percentage
[B].[D].BR.Download.CleanLineVol	RW	VT_R4		Clean line volume (Range is 1 to 999)

OPC Item	Access Type	Data Type	Range	Description
[B].[D].BR.Download.Line1AdditiveAmount	RW	VT_R4		Line 1 additive amount or 0 if disabled
[B].[D].BR.Download.Line2AdditiveAmount	RW	VT_R4		Line 2 additive amount or 0 if disabled
[B].[D].BR.Download.Line3AdditiveAmount	RW	VT_R4		Line 3 additive amount or 0 if disabled
[B].[D].BR.Download.Line4AdditiveAmount	RW	VT_R4		Line 4 additive amount or 0 if disabled
[B].[D].BR.Download.Line5AdditiveAmount	RW	VT_R4		Line 5 additive amount or 0 if disabled
[B].[D].BR.Download.Line6AdditiveAmount	RW	VT_R4		Line 6 additive amount or 0 if disabled
[B].[D].BR.Download.AdditiveFlushVol	RW	VT_R4		Additive flush volume or 0 if no flush volume
[B].[D].BR.Download.WriteBR	RW	VT_UI2	1	Write command flag (1 = Write)
[B].[D].BR.Download.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].BR.Download.Error	R	VT_UI2		Recipe error code
[B].[D].BR.Download.BaseSlowFlow	R	VT_R4		Base calculated slow flow
[B].[D].BR.Download.BaseHighFlow	R	VT_R4		Base calculated high flow
[B].[D].BR.Download.BaseLowFlow	R	VT_R4		Base calculated low flow
[B].[D].BR.Download.BlendSlowFlow	R	VT_R4		Blend calculated slow flow
[B].[D].BR.Download.BlendHighFlow	R	VT_R4		Blend calculated high flow
[B].[D].BR.Download.BlendLowFlow	R	VT_R4		Blend calculated low flow
[B].[D].BR.Download.RecipeMinimumPreset	R	VT_R4		Calculated recipe minimum preset

14.4.7 Clear Power Cycle - CC

TAS/OPC client can clear/reset the power failure flag. The flag is available from the ENQ response bit 4 of the status byte.

TABLE 14-32 lists the OPC items for the CC command.

TABLE 14-32 OPC items for CC command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].CC.WriteCC	RW	VT_UI2	1	Write command flag (1 = Write)
[B].[D].CC.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.4.8 Clear General Purpose Input Latches - CL

TAS/OPC client can clear the latched status byte sent in the IS command for digital inputs by issuing the CL command. This command also clears the RIT status byte in the ENQ command where applicable.

TABLE 14-33 lists the OPC items for the CL command.

TABLE 14-33 OPC items for CL command

OPC Item	Access Type	Data Type	Length	Description
[B].[D].CL.AllInputClear	RW	VT_UI2		Write command flag to clear all latched inputs (1 = Write)
[B].[D].CL.CA20LatchedInputClear	RW	VT_UI2		Write command flag to clear CA20 latched inputs (1 = Write)
[B].[D].CL.CA21LatchedInputClear	RW	VT_UI2		Write command flag to clear CA21 latched inputs (1 = Write)
[B].[D].CL.CA22LatchedInputClear	RW	VT_UI2		Write command flag to clear CA22 latched inputs (1 = Write)
[B].[D].CL.CA23LatchedInputClear	RW	VT_UI2		Write command flag to clear CA23 latched inputs (1 = Write)
[B].[D].CL.CA25LatchedInputClear	RW	VT_UI2		Write command flag to clear CA25 latched inputs (1 = Write)
[B].[D].CL.CA26LatchedInputClear	RW	VT_UI2		Write command flag to clear CA26 latched inputs (1 = Write)
[B].[D].CL.CA27LatchedInputClear	RW	VT_UI2		Write command flag to clear CA27 latched inputs (1 = Write)
[B].[D].CL.CA28LatchedInputClear	RW	VT_UI2		Write command flag to clear CA28 latched inputs (1 = Write)
[B].[D].CL.CB20LatchedInputClear	RW	VT_UI2		Write command flag to clear CB20 latched inputs (1 = Write)
[B].[D].CL.CB21LatchedInputClear	RW	VT_UI2		Write command flag to clear CB21 latched inputs (1 = Write)

OPC Item	Access Type	Data Type	Length	Description
[B].[D].CL.CB22LatchedInputClear	RW	VT_UI2		Write command flag to clear CB22 latched inputs (1 = Write)
[B].[D].CL.CB23LatchedInputClear	RW	VT_UI2		Write command flag to clear CB23 latched inputs (1 = Write)
[B].[D].CL.CB25LatchedInputClear	RW	VT_UI2		Write command flag to clear CB25 latched inputs (1 = Write)
[B].[D].CL.CB26LatchedInputClear	RW	VT_UI2		Write command flag to clear CB26 latched inputs (1 = Write)
[B].[D].CL.CB27LatchedInputClear	RW	VT_UI2		Write command flag to clear CB27 latched inputs (1 = Write)
[B].[D].CL.CB28LatchedInputClear	RW	VT_UI2		Write command flag to clear CB28 latched inputs (1 = Write)
[B].[D].CL.RITArm1InputClear	RW	VT_UI2		Write command flag to clear RIT latched inputs for arm 1 (1 = Write)
[B].[D].CL.RITArm2InputClear	RW	VT_UI2		Write command flag to clear RIT latched inputs for arm 2 (1 = Write)
[B].[D].CL.RITBothArmsInputClear	RW	VT_UI2		Write command flag to clear RIT latched inputs for both arms (1 = Write)
[B].[D].CL.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.4.9 Communication Settings - CO

TAS/OPC client can retrieve the communications settings from the device by issuing the CO command.

REMARK: The CO command can only be used while the device is in the idle state.

There are two options:

- Option 1 - Retrieving the general communication settings (see section 14.4.9.1)
- Option 2 - Retrieving settings for a specific COM port (see section 14.4.9.2)

14.4.9.1 Option 1 - Retrieving the General Communications Settings

TABLE 14-34 lists the OPC items for the CO command, whereby the general communications are retrieved.

TABLE 14-34 OPC Items for CO command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].CO.GeneralSettings.FetchCO	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].CO.GeneralSettings.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].CO.GeneralSettings.CommunicationTimeOut	R	VT_UI2		Comms timeout [seconds]
[B].[D].CO.GeneralSettings.DebugResp	R	VT_UI2		Debug response (0 = DISABLED, 1 = ENABLED)
[B].[D].CO.GeneralSettings.RemoteAuthorinable	R	VT_UI2		Remote authorise (0 = DISABLED, 1 = ENABLED)
[B].[D].CO.GeneralSettings.TASModeEnable	R	VT_UI2		Terminal automation mode (0 = STAND ALONE, 1 = [LOAD SCHEDULING)
[B].[D].CO.GeneralSettings.TotalCOMPorts	R	VT_UI2		Number of communications ports

14.4.9.2 Option 2 - Communication Port Settings

TABLE 14-35 lists the OPC items for the CO command, whereby the communication port settings are retrieved.

REMARK: In the OPC items listed in TABLE 14-35 [n] indicates the number of the communication port and can be 1 to 3.

TABLE 14-35 OPC Items for the CO command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].CO.COMPort[n].FetchCO	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].CO.COMPort[n].DevResp	R	VT_UI2		Device reply to SLIP command 0 = None 1 = ACK 2 = NAK 3 = Busy

OPC Item	Access Type	Data Type	Range	Description
[B].[D].CO.COMPort[n].BaudRate	R	VT_UI2		Communications port baud rate 0 = 300 1 = 600 2 = 1200 3 = 2400 4 = 4800 5 = 9600 6 = 19200 7 = 38,400)
[B].[D].CO.COMPort[n].COMDevice	R	VT_UI2		Communications port n device 0 = COMPUTER 1 = INTELLIGENT ADDITIV 2 = NEXWATCH)
[B].[D].CO.COMPort[n].COMMode	R	VT_UI2		Communications port n mode 0 = RS232 1 = RS485 2 = RS422)
[B].[D].CO.COMPort[n].COMPort	R	VT_BSTR		Communications port number
[B].[D].CO.COMPort[n].Parity	R	VT_UI2		Communications port n parity 0 = NONE 1 = EVEN 2 = ODD)
[B].[D].CO.COMPort[n].StopBits	R	VT_UI2		Communications port stop bits
[B].[D].CO.COMPort[n].UnitAddress	R	VT_UI2		Communications port unit address

14.4.10 Correction Settings - CS

TAS/OPC client can retrieve the commodity based correction settings for all flow meters by issuing the CS command.

REMARK: The CS command can only be used while the device is in the idle state.

There are five options:

- Option 1 - Retrieving the commodity based correction settings for all flow meters (see section 14.4.10.1)
- Option 2 - Retrieving the break down settings for a specific flow meter (see section 14.4.10.2)
- Option 3 - Retrieving the density settings for a specific flow meter (see section 14.4.10.3)
- Option 4 - Retrieving the pressure settings for a specific flow meter (see section 14.4.10.4)
- Option 5 - Retrieving the temperature settings for a specific flow meter (see section 14.4.10.5)

14.4.10.1 Option 1

TABLE 14-36 lists the OPC items for the CS command, whereby the commodity based correction settings for all flow meters are retrieved.

TABLE 14-36 OPC items for CS command - Option 1

OPC Item	Access Type	Data Type	Range	Description
[B].[D].CS.1.FetchCS	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].CS.1.DevResp	R	VT_UI2		Device reply to SLIP command 0 = none 1 = ACK 2 = NAK 3 = Busy
[B].[D].CS.1.M1Commodity	R	VT_UI2		Commodity setting for meter 1
[B].[D].CS.1.M1DensityCorrectionTable	R	VT_BSTR		Density correction table for meter 1
[B].[D].CS.1.M1VolumeCorrectionTable	R	VT_BSTR		Volume correction table for meter 1
[B].[D].CS.1.M2Commodity	R	VT_UI2		Commodity setting for meter 2
[B].[D].CS.1.M2DensityCorrectionTable	R	VT_BSTR		Density correction table for meter 2
[B].[D].CS.1.M2VolumeCorrectionTable	R	VT_BSTR		Volume correction table for meter 2
[B].[D].CS.1.M3Commodity	R	VT_UI2		Commodity setting for meter 3
[B].[D].CS.1.M3DensityCorrectionTable	R	VT_BSTR		Density correction table for meter 3
[B].[D].CS.1.M3VolumeCorrectionTable	R	VT_BSTR		Volume correction table for meter 3
[B].[D].CS.1.M4Commodity	R	VT_UI2		Commodity setting for meter 4
[B].[D].CS.1.M4DensityCorrectionTable	R	VT_BSTR		Density correction table for meter 4
[B].[D].CS.1.M4VolumeCorrectionTable	R	VT_BSTR		Volume correction table for meter 4

14.4.10.1.1 Commodity Types

In TABLE 14-37 the various commodity types are listed.

TABLE 14-37 Commodity Types

No.	Commodity Type
0	NONE
1	CRUDE OILS (A)
2	REFINED (B)
3	SPECIAL (C)
4	LUBE OILS (D)
5	NGL AND LPG (E)

No.	Commodity Type
6	FAME (F)

14.4.10.1.2 Density Correction

In TABLE 14-38 the density correction table for each commodity type is listed.

TABLE 14-38 Density Correction

Commodity Type					Base Temp.
Crude Oils (A)	Refined (B)	Special (C)	Lube Oils (D)	NGL and LPG (E)	
53A	53B	53C	53D	53E	15 °C
59A	59B	59C	59D	59E	20 °C
23A	23B	23C	23D	23E	60 °F

14.4.10.1.3 Volume Correction

In TABLE 14-39 the volume correction table for each commodity type is listed.

TABLE 14-39 Volume Correction

Commodity Type					Base Temp.
Crude Oils (A)	Refined (B)	Special (C)	Lube Oils (D)	NGL and LPG (E)	
54A	54B	54C	54D	54E	15 °C
60A	60B	60C	60D	60E	20 °C
24A	24B	24C	24D	24E	60 °F

14.4.10.2 Option 2

TABLE 14-40 lists the OPC items for the CS command, whereby the break down settings for the flow meter are retrieved.

TABLE 14-40 OPC Items for CS command - Option 2

OPC Item	Access Type	Data Type	Range	Description
[B].[D].CS.BD.MeterNum	RW	VT_UI2		Meter number (Range is 1 to 4)
[B].[D].CS.BD.FetchCS	RW	VT_UI2	1	Fetch command flag (1 = Fetch)

OPC Item	Access Type	Data Type	Range	Description
[B].[D].CS.BD.DevResp	R	VT_UI2		Device reply to SLIP command 0 = None 1 = ACK 2 = NAK 3 = BUSY
[B].[D].CS.BD.DensityBreakDown	R	VT_UI2		Pressure break down value: 0 = DISABLED 1 = ENABLED]
[B].[D].CS.BD.DensityBreakDownValue	R	VT_R4		Pressure break down value
[B].[D].CS.BD.PressureBreakDownEnabled	R	VT_UI2		Pressure break down value: 0 = DISABLED 1 = ENABLED
[B].[D].CS.BD.PressureBreakDownValue	R	VT_R4		Pressure break down value
[B].[D].CS.BD.TempBreakDownEnabled	R	VT_UI2		Temperature break down value: 0 = DISABLED 1 = ENABLED
[B].[D].CS.BD.TempBreakDownValue	R	VT_R4		Temperature break down value

14.4.10.3 Option 3

TABLE 14-41 lists the OPC items for the CS command, whereby the density settings for the flow meter are retrieved.

TABLE 14-41 OPC items for CS command - Option 3

OPC Item	Access Type	Data Type	Range	Description
[B].[D].CS.DS.MeterNum	RW	VT_UI2		Meter number (Range is 1 to 4)
[B].[D].CS.DS.FetchCS	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].CS.DS.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].CS.DS.20MADensity	R	VT_R4		20 mA density
[B].[D].CS.DS.4MADensity	R	VT_R4		4 mA density
[B].[D].CS.DS.DensityCorrection	R	VT_UI2		Density correction: 1 = ENABLED 0 = DISABLED
[B].[D].CS.DS.DensityType	R	VT_UI2		Type of density value: 0 = None 1 = Manual 2 = Analog]

OPC Item	Access Type	Data Type	Range	Description
[B].[D].CS.DS.ManualDensity	R	VT_R4		Manual density value

14.4.10.4 Option 4

TABLE 14-42 lists the OPC items for the CS command, whereby the pressure settings for the flow meter are retrieved.

TABLE 14-42 OPC items for CS command - Option 4

OPC Item	Access Type	Data Type	Range	Description
[B].[D].CS.PS.MeterNum	RW	VT_UI2		Meter number (Range is 0 to 4)
[B].[D].CS.PS.FetchCS	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].CS.PS.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].CS.PS.20MAPressure	R	VT_R4		20 mA pressure
[B].[D].CS.PS.4MAPressure	R	VT_R4		4 mA pressure
[B].[D].CS.PS.CommoditySetting	R	VT_UI2		Commodity setting
[B].[D].CS.PS.ManualCompressabilityFactor	R	VT_R4		Manual compressibility factor
[B].[D].CS.PS.ManualDP	R	VT_R4		Manual entry of DP
[B].[D].CS.PS.PressCorrection	R	VT_UI2		Pressure correction: 0 = DISABLED 1 = ENABLED

14.4.10.5 Option 5

TABLE 14-43 lists the OPC items for the CS command, whereby the temperature settings for the flow meter are retrieved.

TABLE 14-43 OPC items for CS command - Option 5

OPC Item	Access Type	Data Type	Range	Description
[B].[D].CS.TS.MeterNum	RW	VT_UI2		Meter number (Range: 1 to 4)
[B].[D].CS.TS.FetchCS	RW	VT_UI2	1	Fetch command flag (1 = Fetch)

OPC Item	Access Type	Data Type	Range	Description
[B].[D].CS.TS.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].CS.TS.ExpansionCoefficient	R	VT_R4		Expansion co-efficient
[B].[D].CS.TS.MaximumErrorTemp	R	VT_R4		RTD maximum error temperature for RTD or 20 ma
[B].[D].CS.TS.MinimumErrorTemp	R	VT_R4		RTD minimum error temperature for RTD or 4 mA
[B].[D].CS.TS.SensorType	R	VT_UI2		Temperature sensor type: 0 = None in device 1 = RTD 2 = 4-20 mA
[B].[D].CS.TS.TempCorrection	R	VT_UI2		Temperature correction: 0 = DISABLED 1 = ENABLED

14.4.11 Set Meter Density - DN

TAS/OPC Client can download the product density for the specified fluid group for a particular meter to the instrument.

TABLE 14-44 lists the OPC items for the DN command.

TABLE 14-44 OPC items for DN command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].DN.MeterNo	RW	VT_UI2		Meter number for which density must be set
[B].[D].DN.RefDens	RW	VT_R4		Lab density at 15 °C
[B].[D].DN.WriteDN	RW	VT_UI2	1	Write command flag (1 = Write)
[B].[D].DN.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.4.12 Get Date and Time - GD

TAS/OPC client can retrieve the date and time from the device by issuing the GD command.

REMARK: The GD command can only be used while the device is in the idle state.

TABLE 14-45 lists the OPC items for the GD command.

TABLE 14-45 OPC items for GD command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].GD.FetchGD	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].GD.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = AC 2 = NAK 3 = Busy
[B].[D].GD.Date	R	VT_BSTR		Date [dd:mm:yyyy]
[B].[D].GD.Time	R	VT_BSTR		Time [hh:mm:ss]

14.4.13 General Purpose Inputs - GI

TAS/OPC client can retrieve the configuration settings and status for a specific general purpose input by issuing the GI command.

TABLE 14-46 lists the OPC items for the GI command.

TABLE 14-46 OPC items for GI command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].GI.InputNum	RW	VT_UI2		General purpose input number
[B].[D].GI.FetchGI	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].GI.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].GI.AllocArm	R	VT_UI2		Arm number assigned to requested input: 0 = Not applicable 1 = Arm 1 2 = Arm 2 3 = Arm 3 4 = Arm 4]

OPC Item	Access Type	Data Type	Range	Description
[B].[D].GI.InputFun	R	VT_UI2		General purpose input function assigned to the requested general purpose input number: 0 = None 1 = Emergency Stop 2 = Overfill/Ground 3 = Vapour Recovery 4 = Programmable Permissive 5 = System Programmable 1 6 = System Programmable 2 7 = System Programmable 3 8 = System Programmable 4 9 = System Programmable 5 10 = System Programmable 6 11 = Arm Programmable 1 12 = Arm Programmable 2 13 = Arm Programmable 3 14 = Arm Programmable 4 15 = Arm Programmable 5 16 = Arm Programmable 6 17 = Arm Programmable 7 18 = Arm Programmable 8 19 = RIT Start arm 20 = RIT Stop Arm 21 = RIT Ack
[B].[D].GI.InputType	R	VT_UI2		Input type assigned to the requested general purpose input: 0 = None 1 = Emergency stop 2 = Permissive 3 = System Input 4 = Arm Input 5 = RIT input
[B].[D].GI.LoadEffect	R	VT_UI2		General purpose input loading effect: 0 = NONE 1 = PAUSE 2 = TIMEOUT 3 = TERMINATE 4 = MANAGER RESET]
[B].[D].GI.Status	R	VT_UI2		Current general purpose input status: 0 = Open 1 = Closed

14.4.14 General Purpose Outputs - GO

TAS/OPC client can retrieve the configuration settings and status for a specific general purpose output issuing the GO command.

TABLE 14-47 lists the OPC items for the GO command.

TABLE 14-47 OPC items for GO command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].GO.OutputNum	RW	VT_UI2		General purpose output number
[B].[D].GO.FetchGO	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].GO.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].GO.AllocArm	R	VT_UI2		Arm /stream number assigned to requested output: 0 = None 1= Alarm output 2 = Stream Control output 3 = Control valve output 4 = Additive output 5 = Internal additive output 6 = RIT output]
[B].[D].GO.OPCondition	R	VT_UI2		General purpose output condition: 0 = normally open 1 = normally closed

OPC Item	Access Type	Data Type	Range	Description
[B].[D].GO.OutputFun	R	VT_UI2		Output function assigned to the requested general purpose output: 0 = None 1 = Deadman Indicator 2 = Deadman Bell 3 = Deadman Callout 4 = System Alarm 5 = Device Alarm 6 = Bay Active 7 = ESD 8 = Pump Demand 9 = Isolation Valve (Range: Stream 1 to max available on system) 10 = DCV Inlet (Range: Stream 1 to max available on system) 11 = DCV Outlet (Range: Stream 1 to max available on system) 12 = Additive Pulse Prod 13 = Int. Additive Pulse 1 14 = Int. Additive Pulse 2 15 = Int. Additive Pulse 3 16 = Int. Additive Pulse 4 17 = Int. Additive Pulse 5 18 = Int. Additive Pulse 6 19 = Additive Pump Demand 1 (Range: Stream 1 to max available on system) 20 = Additive Pump Demand 2 (Range: Stream 1 to max available on system) 21 = Additive Pump Demand 3 (Range: Stream 1 to max available on system) 22 = Additive Pump Demand 4 (Range: Stream 1 to max available on system) 23 = Additive Pump Demand 5 (Range: Stream 1 to max available on system) 24 = Additive Pump Demand 6 (Range: Stream 1 to max available on system) 25 = RIT Red (Range: Arm 1 to max available on system)
				26 = RIT Amber (Range: Arm 1 to max available on system) 27 = RIT Green (Range: Arm 1 to max available on system)

OPC Item	Access Type	Data Type	Range	Description
[B].[D].GO.OutputType	R	VT_UI2		Output type assigned to the requested general purpose output: 0 = None 1= Alarm output 2 = Stream Control output 3 = Control valve output 4 = Additive output 5 = Internal additive output 6 = RIT output
[B].[D].GO.Status	R	VT_UI2		General purpose output status: 0 = Inactive 1 = Active

14.4.15 Injector Accumulative Total - IA

TAS/OPC client can retrieve the accumulative total for a specific additive injector by issuing the IA command.

REMARK: The IA command can only be used while the instrument is in the idle state.

There are two options:

- Option 1 - Retrieving the accumulative total for a specific additive injector (see section 14.4.15.1)
- Option 2 - Retrieving the accumulative total for a specific loading arm (see section 14.4.15.2)

14.4.15.1 Option 1

TABLE 14-48 lists the OPC items for the IA command, whereby the accumulative total for a specific additive injector are retrieved.

TABLE 14-48 OPC items for IA command - Option 1

OPC Item	Access Type	Data Type	Range	Description
[B].[D].IA.1.InjNum	RW	VT_UI2		Additive injector number (Range: 1 to 24, 1 to 18 are used for external additive, 19 to 24 are used for internal additives)
[B].[D].IA.1.FetchIA	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].IA.1.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].IA.1.TotalVol	R	VT_R8		Additive total [litres/gallons]

14.4.15.2 Option 2

TABLE 14-49 lists the OPC items for the IA command, whereby the accumulative total for a specific loading arm is retrieved.

REMARK: In the OPC items listed in TABLE 14-49 [n] indicates the loading arm number and can be 1 to 4.

TABLE 14-49 OPC items for IA Command - Option 2

OPC Item	Access Type	Data Type	Range	Description
[B].[D].IA.2.A[n].FetchIA	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].IA.2.A[n].DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].IA.2.A[n].ArmNum	R	VT_UI2		Arm number
[B].[D].IA.2.A[n].Injector1AdditiveTotal	R	VT_R8		Injector point 1 additive accumulated total
[B].[D].IA.2.A[n].Injector2AdditiveTotal	R	VT_R8		Injector point 2 additive accumulated total
[B].[D].IA.2.A[n].Injector3AdditiveTotal	R	VT_R8		Injector point 3 additive accumulated total
[B].[D].IA.2.A[n].Injector4AdditiveTotal	R	VT_R8		Injector point 4 additive accumulated total
[B].[D].IA.2.A[n].Injector5AdditiveTotal	R	VT_R8		Injector point 5 additive accumulated total
[B].[D].IA.2.A[n].Injector6AdditiveTotal	R	VT_R8		Injector point 6 additive accumulated total

14.4.16 General Purpose Input Status - IS

TAS/OPC client can retrieve the current status as well as the latched status since the last CL command for all inputs of the device by issuing the IS command.

TABLE 14-50 lists the OPC items for the IS command.

TABLE 14-50 OPC items for IS Command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].IS.FetchIS	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].IS.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

OPC Item	Access Type	Data Type	Range	Description
[B].[D].IS.GeneralPurposeInputCA20ActiveHigh	R	VT_BOOL		General purpose input latched (active high) status byte for inputs CA20
[B].[D].IS.GeneralPurposeInputCA20ActiveLow	R	VT_BOOL		General purpose input latched (active low) status byte for inputs CA20
[B].[D].IS.GeneralPurposeInputCA20CurrentStatus	R	VT_BOOL		General purpose input current status byte for inputs CA20
[B].[D].IS.GeneralPurposeInputCA21ActiveHigh	R	VT_BOOL		General purpose input latched (active high) status byte for inputs CA21
[B].[D].IS.GeneralPurposeInputCA21ActiveLow	R	VT_BOOL		General purpose input latched (active low) status byte for inputs CA21
[B].[D].IS.GeneralPurposeInputCA21CurrentStatus	R	VT_BOOL		General purpose input current status byte for inputs CA21
[B].[D].IS.GeneralPurposeInputCA22ActiveHigh	R	VT_BOOL		General purpose input latched (active high) status byte for inputs CA22
[B].[D].IS.GeneralPurposeInputCA22ActiveLow	R	VT_BOOL		General purpose input latched (active low) status byte for inputs CA22
[B].[D].IS.GeneralPurposeInputCA22CurrentStatus	R	VT_BOOL		General purpose input current status byte for inputs CA22
[B].[D].IS.GeneralPurposeInputCA23ActiveHigh	R	VT_BOOL		General purpose input latched (active high) status byte for inputs CA23
[B].[D].IS.GeneralPurposeInputCA23ActiveLow	R	VT_BOOL		General purpose input latched (active low) status byte for inputs CA23
[B].[D].IS.GeneralPurposeInputCA23CurrentStatus	R	VT_BOOL		General purpose input current status byte for inputs CA23
[B].[D].IS.GeneralPurposeInputCA25ActiveHigh	R	VT_BOOL		General purpose input latched (active high) status byte for inputs CA25
[B].[D].IS.GeneralPurposeInputCA25ActiveLow	R	VT_BOOL		General purpose input latched (active low) status byte for inputs CA25

OPC Item	Access Type	Data Type	Range	Description
[B].[D].IS.GeneralPurposeInputCA25CurrentStatus	R	VT_BOOL		General purpose input current status byte for inputs CA25
[B].[D].IS.GeneralPurposeInputCA26ActiveHigh	R	VT_BOOL		General purpose input latched (active high) status byte for inputs CA26
[B].[D].IS.GeneralPurposeInputCA26ActiveLow	R	VT_BOOL		General purpose input latched (active low) status byte for inputs CA26
[B].[D].IS.GeneralPurposeInputCA26CurrentStatus	R	VT_BOOL		General purpose input current status byte for inputs CA26
[B].[D].IS.GeneralPurposeInputCA27ActiveHigh	R	VT_BOOL		General purpose input latched (active high) status byte for inputs CA27
[B].[D].IS.GeneralPurposeInputCA27ActiveLow	R	VT_BOOL		General purpose input latched (active low) status byte for inputs CA27
[B].[D].IS.GeneralPurposeInputCA27CurrentStatus	R	VT_BOOL		General purpose input current status byte for inputs CA27
[B].[D].IS.GeneralPurposeInputCA28ActiveHigh	R	VT_BOOL		General purpose input latched (active high) status byte for inputs CA28
[B].[D].IS.GeneralPurposeInputCA28ActiveLow	R	VT_BOOL		General purpose input latched (active low) status byte for inputs CA28
[B].[D].IS.GeneralPurposeInputCA28CurrentStatus	R	VT_BOOL		General purpose input current status byte for inputs CA28
[B].[D].IS.GeneralPurposeInputCB20ActiveHigh	R	VT_BOOL		General purpose input latched (active high) status byte for inputs CB20
[B].[D].IS.GeneralPurposeInputCB20ActiveLow	R	VT_BOOL		General purpose input latched (active low status byte for inputs CB20
[B].[D].IS.GeneralPurposeInputCB20CurrentStatus	R	VT_BOOL		General purpose input current status byte for inputs CB20
[B].[D].IS.GeneralPurposeInputCB21ActiveHigh	R	VT_BOOL		General purpose input latched (active high) status byte for inputs CB21

OPC Item	Access Type	Data Type	Range	Description
[B].[D].IS.GeneralPurposeInputCB21ActiveLow	R	VT_BOOL		General purpose input latched (active low) status byte for inputs CB21
[B].[D].IS.GeneralPurposeInputCB21CurrentStatus	R	VT_BOOL		General purpose input current status byte for inputs CB21
[B].[D].IS.GeneralPurposeInputCB22ActiveHigh	R	VT_BOOL		General purpose input latched (active high) status byte for inputs CB22
[B].[D].IS.GeneralPurposeInputCB22ActiveLow	R	VT_BOOL		General purpose input latched (active low) status byte for inputs CB22
[B].[D].IS.GeneralPurposeInputCB22CurrentStatus	R	VT_BOOL		General purpose input current status byte for inputs CB22
[B].[D].IS.GeneralPurposeInputCB23ActiveHigh	R	VT_BOOL		General purpose input latched (active high) status byte for inputs CB23
[B].[D].IS.GeneralPurposeInputCB23ActiveLow	R	VT_BOOL		General purpose input latched (active low) status byte for inputs CB23
[B].[D].IS.GeneralPurposeInputCB23CurrentStatus	R	VT_BOOL		General purpose input current status byte for inputs CB23
[B].[D].IS.GeneralPurposeInputCB25ActiveHigh	R	VT_BOOL		General purpose input latched (active high) status byte for inputs CB25
[B].[D].IS.GeneralPurposeInputCB25ActiveLow	R	VT_BOOL		General purpose input latched (active low) status byte for inputs CB25
[B].[D].IS.GeneralPurposeInputCB25CurrentStatus	R	VT_BOOL		General purpose input current status byte for inputs CB25
[B].[D].IS.GeneralPurposeInputCB26ActiveHigh	R	VT_BOOL		General purpose input latched (active high) status byte for inputs CB26
[B].[D].IS.GeneralPurposeInputCB26ActiveLow	R	VT_BOOL		General purpose input latched (active low) status byte for inputs CB26
[B].[D].IS.GeneralPurposeInputCB26CurrentStatus	R	VT_BOOL		General purpose input current status byte for inputs CB26

OPC Item	Access Type	Data Type	Range	Description
[B].[D].IS.GeneralPurposeInputCB27ActiveHigh	R	VT_BOOL		General purpose input latched (active high) status byte for inputs CB27
[B].[D].IS.GeneralPurposeInputCB27ActiveLow	R	VT_BOOL		General purpose input latched (active low) status byte for inputs CB27
[B].[D].IS.GeneralPurposeInputCB27CurrentStatus	R	VT_BOOL		General purpose input current status byte for inputs CB27
[B].[D].IS.GeneralPurposeInputCB28ActiveHigh	R	VT_BOOL		General purpose input latched (active high) status byte for inputs CB28
[B].[D].IS.GeneralPurposeInputCB28ActiveLow	R	VT_BOOL		General purpose input latched (active low) status byte for inputs CB28
[B].[D].IS.GeneralPurposeInputCB28CurrentStatus	R	VT_BOOL		General purpose input current status byte for inputs CB28

14.4.17 Loading Arm Information - LA

TAS/OPC client can send the loading arm information from the computer to the device by issuing the LA command.

REMARK: The LA command can only be issued while the device is in the LA state.

TABLE 14-51 lists the OPC items for the LA command.

TABLE 14-51 OPC items for LA Command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].LA.ArmNum	RW	VT_UI2		Arm number
[B].[D].LA.CompNum	RW	VT_UI2		Compartment number (Range: 1 to 99)
[B].[D].LA.WriteLA	RW	VT_UI2	1	Write command flag (1 = Write)
[B].[D].LA.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].LA.LoadNum	R	VT_BSTR		Load number

14.4.18 Alter Meter Name - MN

TAS/OPC client can alter the name of a flow meter issuing the MN command to the device.

TABLE 14-52 lists the OPC items for the MN command.

TABLE 14-52 OPC items for MN Command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].MN.MeterNum	RW	VT_UI2	1 to 4	Meter number (Range: 1 to 4)
[B].[D].MN.MeterName	RW	VT_BSTR		Meter name
[B].[D].MN.WriteMN	RW	VT_UI2	1	Write command flag (1 = Write)
[B].[D].MN.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.4.19 Manager Reset - MR

TAS/OPC client can perform a manager reset by issuing the MR command. Execution of the command has the same effect as a manual manager reset performed by entering the manager password into the device.

The command clears the following:

- Authorisation lockout due to illegal access attempts exceeding the programmed value
- Temperature and pressure fault alarms on all loading arms
- Dual pulse fault alarms on all loading arms
- Phase error alarms on all loading arms
- Emergency Stop condition
- Error for programmable inputs with loading effect set to Manager Reset

TABLE 14-53 lists the OPC items for the MR command.

TABLE 14-53 OPC items for the MR command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].MR.WriteMR	RW	VT_UI2	1	Write command flag (1 = Write)

OPC Item	Access Type	Data Type	Range	Description
[B].[D].MR.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.4.20 Flow Meter Settings - MS

TAS/OPC client can retrieve the settings for a specific flow meter by issuing the MS command.

REMARK: The MS command can only used while the device is in the idle state.

TABLE 14-54 lists the OPC items for the MS command.

REMARK: In the OPC items listed in TABLE 14-54 [n] indicates the flow meter number and can be 1 to 4.

TABLE 14-54 OPC items for MS command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].MS.[n].FetchMS	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].MS.[n].DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].MS.[n].CalibrationDate	R	VT_BSTR		Calibration date
[B].[D].MS.[n].CalibrationNum	R	VT_BSTR		Calibration number
[B].[D].MS.[n].CalibrationTime	R	VT_BSTR		Calibration time
[B].[D].MS.[n].CutOffFrequency	R	VT_R4		Cut off frequency for dual pulse or 0 for single pulse
[B].[D].MS.[n].Frequency1	R	VT_R4		First frequency for non-linear or k-factor if linear
[B].[D].MS.[n].Frequency2	R	VT_R4		Second frequency for non-linear or k-factor if linear
[B].[D].MS.[n].Frequency3	R	VT_R4		Third frequency for non-linear or k-factor if linear
[B].[D].MS.[n].Frequency4	R	VT_R4		Fourth frequency for non-linear or k-factor if linear
[B].[D].MS.[n].Frequency5	R	VT_R4		Fifth frequency for non-linear or k-factor if linear
[B].[D].MS.[n].IPFilter	R	VT_UI2		Flow meter input filter

OPC Item	Access Type	Data Type	Range	Description
[B].[D].MS.[n].IPResistor	R	VT_UI2		Flow meter input resistor
[B].[D].MS.[n].KFactor1	R	VT_R4		First k-factor for non-linear
[B].[D].MS.[n].KFactor2	R	VT_R4		Second k-factor for non-linear
[B].[D].MS.[n].KFactor3	R	VT_R4		Third k-factor for non-linear
[B].[D].MS.[n].KFactor4	R	VT_R4		Fourth k-factor for non-linear
[B].[D].MS.[n].KFactor5	R	VT_R4		Fifth k-factor for non-linear
[B].[D].MS.[n].KFactorType	R	VT_BSTR		Linear or non-linear k-factor
[B].[D].MS.[n].MeterFactor	R	VT_R4		Meter factor
[B].[D].MS.[n].MeterName	R	VT_BSTR		Meter name
[B].[D].MS.[n].MeterNum	R	VT_UI2		Meter number
[B].[D].MS.[n].MinLinearFlowrate	R	VT_R4		Minimum linear flow rate
[B].[D].MS.[n].MinPreset	R	VT_R4		Minimum preset amount
[B].[D].MS.[n].NLKFactorNum	R	VT_UI2		Number of non-linear k-factors or 0 if linear k-factor
[B].[D].MS.[n].OverRunQty	R	VT_R4		Overrun quantity
[B].[D].MS.[n].PulseType	R	VT_BSTR		Single or dual pulse
[B].[D].MS.[n].UnauthorisedThresholdFlow	R	VT_R4		Unauthorized flow threshold

14.4.21 Preset - PR

TAS/OPC client can retrieve the minimum presets by issuing the PR command to the device.

There are two options:

- Option 1 - Retrieving the minimum preset for all loading arms (see section 14.4.21.1)
- Option 2 - Retrieving the minimum preset for a specific flow meter (see section 14.4.21.2)

14.4.21.1 Option 1 - Minimum Preset for All Loading Arms

TABLE 14-55 lists the OPC items for the PR command, whereby the minimum preset for all loading arms is retrieved.

TABLE 14-55 OPC items for PR command - Option 2

OPC Item	Access Type	Data Type	Range	Description
[B].[D].PR.1.FetchPR	RW	VT_UI2	1	Fetch command flag (1 = Fetch)

OPC Item	Access Type	Data Type	Range	Description
[B].[D].PR.1.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].PR.1.A1Preset	R	VT_R4		Preset of first arm
[B].[D].PR.1.A2Preset	R	VT_R4		Preset of second arm
[B].[D].PR.1.A3Preset	R	VT_R4		Preset of third arm
[B].[D].PR.1.A4Preset	R	VT_R4		Preset of fourth arm
[B].[D].PR.1.BayNum	R	VT_UI2		Bay number
[B].[D].PR.1.FirstArmNum	R	VT_UI2		First arm number
[B].[D].PR.1.TotalArms	R	VT_UI2		Number of arms

14.4.21.2 Option 2 - Minimum Preset for Flow Meter

TABLE 14-56 lists the OPC items for the PR command, whereby the minimum preset for a flow meter is retrieved

REMARK: In the OPC items listed in TABLE 14-56 [n] indicates the flow meter number and can be 1 to 4.

TABLE 14-56 OPC items for PR command - Option 2

OPC Item	Access Type	Data Type	Range	Description
[B].[D].PR.M[n].FetchPR	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].PR.M[n].DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].PR.M[n].Preset	R	VT_R4		Preset for the meter

14.4.22 Reset Date and Time - RD

TAS/OPC client can set the device's date and time by issuing the RD command to the device.

REMARK: The RD command can only be used while the device is in the idle state.

TABLE 14-57 lists the OPC items for the RD command.

TABLE 14-57 OPC items for RD command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].RD.Date	RW	VT_BSTR		Device's date [ddmmyyyy]
[B].[D].RD.Time	RW	VT_BSTR		Device's time [hhmmss]
[B].[D].RD.WriteRD	RW	VT_UI2	1	Write command flag (1 = Write)
[B].[D].RD.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.4.23 Set RIT Lamps - SL

TAS/OPC client can set the condition of the RIT lamps by updating the following OPC items with the required value, and by subsequently issuing the SL command.

TABLE 14-58 lists the OPC items for the SL command.

TABLE 14-58 OPC items for SL command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].SL.A1FlashGreen	RW	VT_BOOL		Arm 1 Flash Green
[B].[D].SL.A1FlashRed	RW	VT_BOOL		Arm 1 Flash Red
[B].[D].SL.A1FlashYellow	RW	VT_BOOL		Arm 1 Flash Yellow
[B].[D].SL.A1Spare1	R	VT_BOOL		Arm 1 Spare1
[B].[D].SL.A1Spare2	R	VT_BOOL		Arm 1 Spare2
[B].[D].SL.A1SteadyGreen	RW	VT_BOOL		Arm 1 Steady Green
[B].[D].SL.A1SteadyRed	RW	VT_BOOL		Arm 1 Steady Red
[B].[D].SL.A1SteadyYellow	RW	VT_BOOL		Arm 1 Steady Yellow
[B].[D].SL.A2FlashGreen	RW	VT_BOOL		Arm 2 Flash Green
[B].[D].SL.A2FlashRed	RW	VT_BOOL		Arm 2 Flash Red
[B].[D].SL.A2FlashYellow	RW	VT_BOOL		Arm 2 Flash Yellow
[B].[D].SL.A2Spare1	R	VT_BOOL		Arm 2 Spare1
[B].[D].SL.A2Spare2	R	VT_BOOL		Arm 2 Spare2
[B].[D].SL.A2SteadyGreen	RW	VT_BOOL		Arm 2 Steady Green
[B].[D].SL.A2SteadyRed	RW	VT_BOOL		Arm 2 Steady Red
[B].[D].SL.A2SteadyYellow	RW	VT_BOOL		Arm 2 Steady Yellow

OPC Item	Access Type	Data Type	Range	Description
[B].[D].SL.WriteSL	RW	VT_UI2	1	Write command flag (1 = Write)
[B].[D].SL.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.4.24 Stop Arm - SM

TAS/OPC client can stop or pause the load/batch on a particular loading arm by issuing the SM command to the device.

TABLE 14-59 lists the OPC items for the SM command.

TABLE 14-59 OPC items for SM command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].SM.ArmNum	RW	VT_UI2		Arm number
[B].[D].SM.WriteSM	RW	VT_UI2	1	Write command flag (1 = Write)
[B].[D].SM.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.4.25 System Options - SO

TAS/OPC client can retrieve the user configuration settings of the SYSTEM set-up menu by issuing the SO command to the device.

REMARK: The SO command can only be used while the device is in the idle state.

TABLE 14-60 lists the OPC items for the CO command.

TABLE 14-60 OPC Items for SO command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].SO.FetchSO	RW	VT_UI2	1	Fetch command flag (1 = Fetch)

OPC Item	Access Type	Data Type	Range	Description
[B].[D].SO.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].SO.BaseTemperature	R	VT_BSTR		Base temperature
[B].[D].SO.BatchType	R	VT_BSTR		Batch type: NET or GROSS
[B].[D].SO.BayNum	R	VT_UI2		Bay number
[B].[D].SO.ClearTime	R	VT_R4		Clear/reconnect time [seconds]
[B].[D].SO.EntryTimeout	R	VT_R4		Entry timeout [seconds]
[B].[D].SO.FirstArmNum	R	VT_UI2		First arm number
[B].[D].SO.HWTest8Key	R	VT_UI2		Hardware test via 8 key
[B].[D].SO.InitMsg	R	VT_BSTR		Initial message
[B].[D].SO.LangOption	R	VT_BSTR		Language option
[B].[D].SO.LitSpelling	R	VT_BSTR		Litre/liter spelling
[B].[D].SO.MasIdTASOvrRide	R	VT_UI2		Master ID TAS override
[B].[D].SO.MasterAuth	R	VT_BSTR		Master authorisation
[B].[D].SO.PersAuth	R	VT_BSTR		Personnel authorisation
[B].[D].SO.SysUnits	R	VT_BSTR		System units
[B].[D].SO.TotalArms	R	VT_UI2		Number of arms
[B].[D].SO.VehAuth	R	VT_BSTR		Vehicle authorisation
[B].[D].SO.VolDec	R	VT_R4		Volume decimals

14.4.26 Send Transaction - ST

Loading information for each vehicle is stored in two sections in the devices. The two sections are called TRANSACTION and BATCH. The transaction contains information about the load that is common to all the compartments loaded, for example personnel, vehicle, date, start time, load number and so on. The batch information contains information for each compartment that the device has attempted to load, for example compartment number, arm number, preset quantity, gross loaded and so on.

TAS/OPC client can retrieve a transaction by issuing the ST command.

REMARK: The ST command can only be used while the device is in the idle state.

TABLE 14-61 lists the OPC items for the ST command.

TABLE 14-61 OPC Items for ST command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].ST.TransNum	RW	VT_UI2		Transaction number
[B].[D].ST.FetchST	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].ST.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].ST.BayNum	R	VT_UI2		Bay number
[B].[D].ST.CalibNum	R	VT_BSTR		Calibration number
[B].[D].ST.FirstArmNum	R	VT_UI2		First arm number
[B].[D].ST.LoadNum	R	VT_UI4		Load number
[B].[D].ST.MasterIndex	R	VT_BSTR		Master index
[B].[D].ST.PerIndex	R	VT_BSTR		Personnel index
[B].[D].ST.PowCycCount	R	VT_UI2		Power cycle count
[B].[D].ST.RefNum	R	VT_BSTR		Reference number
[B].[D].ST.Result	R	VT_BSTR		Checksum result
[B].[D].ST.StartBatch	R	VT_UI2		Batch start
[B].[D].ST.StartDate	R	VT_BSTR		Date start
[B].[D].ST.StartTime	R	VT_BSTR		Start time [in hh:mm:ss format]
[B].[D].ST.StopBatch	R	VT_UI2		Batch stop
[B].[D].ST.StopTime	R	VT_BSTR		Stop time [in hh:mm:ss format]
[B].[D].ST.TASMode	R	VT_UI2		Communication mode
[B].[D].ST.TotalArms	R	VT_UI2		Number of arms
[B].[D].ST.UniqueNum	R	VT_UI4		Unique number
[B].[D].ST.UnitAddress	R	VT_UI2		Unit address
[B].[D].ST.VehIndex	R	VT_BSTR		Vehicle index

14.4.27 Software Version - SV

TAS/OPC client can retrieve the device’s software version number and the date and time the library was last modified by issuing the SV command.

REMARK: The SV command can only be used while the device is in the idle mode.

TABLE 14-62 lists the OPC items for the SV command.

TABLE 14-62 OPC Items for SV command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].SV.FetchSV	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].SV.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].SV.AppVersion	R	VT_BSTR		Application Version number
[B].[D].SV.Date	R	VT_BSTR		Date [in dd:mm:yyyy format]
[B].[D].SV.DisplayType	R	VT_BSTR		Display type: GRAPHIC
[B].[D].SV.ROMSize	R	VT_UI2		Flash ROM size
[B].[D].SV.ROMType	R	VT_BSTR		ROM Type: FLASH
[B].[D].SV.Time	R	VT_BSTR		Time [in hh:mm:ss format]

14.4.28 Send Batch - SY

Loading information for each vehicle is stored in two sections in the devices. The two sections are called TRANSACTION and BATCH. The transaction contains information about the load that is common to all the compartments loaded, for example personnel, vehicle, date, start time, load number and so on. The batch information contains information for each compartment that the device has attempted to load, for example compartment number, arm number, preset quantity, gross loaded and so on.

TAS/OPC client can retrieve an individual batch, representing a single compartment load by uploading the following OPC items with the required value, and by subsequently issuing the SY command.

There may be up to 20 of these batches per transaction.

There are four options:

- Option 1 - Retrieving the batch information for a loading arm (see section 14.4.28.1)
- Option 2 - Retrieving the batch information for a base flow meter (see section 14.4.28.2)
- Option 3 - Retrieving the batch information for a blend flow meter (see section 14.4.28.3)
- Option 4 - Retrieving the batch information for a additive injector (see section 14.4.28.4)

REMARK: The SY command can only be used while the device is in the idle state.

14.4.28.1 Option 1

TABLE 14-63 lists the OPC items for the SY command, whereby the batch information for a particular loading arm is retrieved.

TABLE 14-63 OPC items for SY command - Option 1

OPC Item	Access Type	Data Type	Range	Description
[B].[D].SY.AA.BatchNum	RW	VT_UI2		Batch number
[B].[D].SY.AA.FetchSY	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].SY.AA.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].SY.AA.ArmNum	R	VT_UI2		Arm number
[B].[D].SY.AA.BlendAccy	R	VT_UI2		Blend accuracY: 0 = No fault 1 = High Alarm 2 = Low Alarm
[B].[D].SY.AA.BlendType	R	VT_UI2		Blend type
[B].[D].SY.AA.CompNum	R	VT_UI2		Compartment number
[B].[D].SY.AA.Error	R	VT_BSTR		Error status
[B].[D].SY.AA.Preset	R	VT_R4		Preset quantity
[B].[D].SY.AA.ReceipeNum	R	VT_UI2		Recipe number
[B].[D].SY.AA.Result	R	VT_BSTR		Checksum result
[B].[D].SY.AA.RetQty	R	VT_R4		Returned quantity
[B].[D].SY.AA.StartTime	R	VT_BSTR		Start time [in hh:mm:ss format]
[B].[D].SY.AA.StopTime	R	VT_BSTR		Stop time [in hh:mm:ss format]
[B].[D].SY.AA.TransNum	R	VT_UI2		Transaction number
[B].[D].SY.AA.Units	R	VT_BSTR		Units setting

14.4.28.2 Option 2

TABLE 14-64 lists the OPC items for the SY command, whereby the batch information for a particular base flow meter is retrieved.

TABLE 14-64 OPC items for SY command - Option 2

OPC Item	Access Type	Data Type	Range	Description
[B].[D].SY.M1.BatchNum	RW	VT_UI2		Batch number

OPC Item	Access Type	Data Type	Range	Description
[B].[D].SY.M1.FetchSY	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].SY.M1.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].SY.M1.Commodity	R	VT_UI2		Commodity setting 0 = NONE 1 = CRUDE OILS (A) 2 = REFINED (B) 3 = SPECIAL (C) 4 = LUBE OILS (D) 5 = NGL AND LPG (E) 6 = FAME (F)
[B].[D].SY.M1.DensFWA	R	VT_R4		Product meter calculated density at meter flow weighted average
[B].[D].SY.M1.Error	R	VT_BSTR		Error status
[B].[D].SY.M1.ExpCoeff	R	VT_R4		Expansion co-efficient/Thermal expansion factor
[B].[D].SY.M1.GOV	R	VT_R4		Loaded Gross Observed Volume through product meter
[B].[D].SY.M1.GOVaccAft	R	VT_R8		Product meter Accumulative Total Gross Observed Volume before batch
[B].[D].SY.M1.GOVaccBef	R	VT_R8		Product meter Accumulative Total Gross Observed Volume after batch
[B].[D].SY.M1.GSV	R	VT_R4		Loaded Gross Standard Volume through product meter
[B].[D].SY.M1.GSVaccAft	R	VT_R8		Product meter Accumulative Total Gross Standard Volume before batch
[B].[D].SY.M1.GSVaccBef	R	VT_R8		Product meter Accumulative Total Gross Standard Volume after batch
[B].[D].SY.M1.MeterNum	R	VT_UI2		Meter number
[B].[D].SY.M1.Preset	R	VT_R4		Meter preset
[B].[D].SY.M1.PressFWA	R	VT_R4		Product meter batch pressure flow weighted average
[B].[D].SY.M1.ProdDensObs	R	VT_R4		Product meter product observed density
[B].[D].SY.M1.Result	R	VT_BSTR		Checksum result
[B].[D].SY.M1.TempFWA	R	VT_R4		Product meter batch temperature flow weighted average
[B].[D].SY.M1.TransNum	R	VT_UI2		Transaction number

14.4.28.3 Option 3

TABLE 14-65 lists the OPC items for the SY command, whereby the batch information for a particular blend flow meter is retrieved.

TABLE 14-65 OPC items for SY command - Option 3

OPC Item	Access Type	Data Type	Range	Description
[B].[D].SY.M2.BatchNum	RW	VT_UI2		Batch number
[B].[D].SY.M2.FetchSY	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].SY.M2.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].SY.M2.Commodity	R	VT_UI2		Commodity setting 0 = NONE 1 = CRUDE OILS (A) 2 = REFINED (B) 3 = SPECIAL (C) 4 = LUBE OILS (D) 5 = NGL AND LPG (E) 6 = FAME (F)
[B].[D].SY.M2.DensFWA	R	VT_R4		Blend Meter batch flow weighted average density
[B].[D].SY.M2.Error	R	VT_BSTR		Error status
[B].[D].SY.M2.ExpCoeff	R	VT_R4		Expansion co-efficient/Thermal expansion factor
[B].[D].SY.M2.GOV	R	VT_R4		Loaded gross observed volume through blend meter
[B].[D].SY.M2.GOVaccAft	R	VT_R4		Blend meter accumulative total gross observed volume after batch
[B].[D].SY.M2.GOVaccBef	R	VT_R4		Blend meter accumulative total gross observed volume before batch
[B].[D].SY.M2.GSV	R	VT_R4		Loaded gross standard volume through blend meter
[B].[D].SY.M2.GSVaccAft	R	VT_R4		Blend meter accumulative total gross standard volume after batch
[B].[D].SY.M2.GSVaccBef	R	VT_R4		Blend meter accumulative total gross standard volume before batch
[B].[D].SY.M2.MeterNum	R	VT_UI2		Meter number
[B].[D].SY.M2.Preset	R	VT_R4		Meter preset
[B].[D].SY.M2.PressFWA	R	VT_R4		Blend meter batch flow weighted average pressure
[B].[D].SY.M2.ProdDensObs	R	VT_R4		Blend meter product observed density

OPC Item	Access Type	Data Type	Range	Description
[B].[D].SY.M2.Result	R	VT_BSTR		Checksum result
[B].[D].SY.M2.TempFWA	R	VT_R4		Blend meter batch flow weighted average temperature
[B].[D].SY.M2.TransNum	R	VT_UI2		Transaction number

14.4.28.4 Option 4

TABLE 14-66 lists the OPC items for the SY command, whereby the batch information for a particular additive injector is retrieved.

TABLE 14-66 OPC items for SY command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].SY.IV.BatchNum	RW	VT_UI2		Batch number
[B].[D].SY.IV.FetchSY	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].SY.IV.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].SY.IV.Line1Qty	R	VT_R4		Quantity line 1
[B].[D].SY.IV.Line2Qty	R	VT_R4		Quantity line 2
[B].[D].SY.IV.Line3Qty	R	VT_R4		Quantity line 3
[B].[D].SY.IV.Line4Qty	R	VT_R4		Quantity line 4
[B].[D].SY.IV.Line5Qty	R	VT_R4		Quantity line 5
[B].[D].SY.IV.Line6Qty	R	VT_R4		Quantity line 6
[B].[D].SY.IV.Result	R	VT_BSTR		Checksum result: FAULT or OK
[B].[D].SY.IV.TransNum	R	VT_UI2		Transaction number

14.4.29 Type of Loading Arm - TA

TAS/OPC client can retrieve the type of loading arm and the number of flow meters associated with that loading arm by issuing the TA command.

REMARK: The TA command can only be used while the device is in the idle state.

TABLE 14-67 lists the OPC items for the TA command.

REMARK: In the OPC items listed in TABLE 14-67 [n] indicates the loading arm number and can be 1 to 4.

TABLE 14-67 OPC items for TA command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].TA.[n].FetchTA	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].TA.[n].DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].TA.[n].ArmNum	R	VT_UI2		Arm number
[B].[D].TA.[n].ArmType	R	VT_UI2		Arm type
[B].[D].TA.[n].BaseMeterNum	R	VT_UI2		Base meter number
[B].[D].TA.[n].TotalMeters	R	VT_UI2		Number of meters

14.4.30 Blend Target and Ratio - TB

TAS/OPC client can retrieve the blend target and ratio for all loading arms by issuing the TB command.

TABLE 14-68 lists the OPC items for the TB command.

TABLE 14-68 OPC items for TB command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].TB.FetchTB	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].TB.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].TB.A1CurrentRatio	R	VT_R4		Current ratio for first arm
[B].[D].TB.A1TargetRatio	R	VT_R4		Target ratio for first arm
[B].[D].TB.A2CurrentRatio	R	VT_R4		Current ratio for second arm
[B].[D].TB.A2TargetRatio	R	VT_R4		Target ratio for second arm
[B].[D].TB.BayNum	R	VT_UI2		Bay number
[B].[D].TB.FirstArmNum	R	VT_UI2		First arm number
[B].[D].TB.TotalArms	R	VT_UI2		Number of arms

14.4.31 Actual and Current Target Flow - TF

TAS/OPC client can retrieve the actual and current target flow rates for all loading arms or for a particular flow meter by issuing the TF command.

14.4.31.1 Actual and Current Target Flow for All Loading Arms

TABLE 14-69 lists the OPC items for the TF command, whereby the actual and current target flows for all loading arms are retrieved.

TABLE 14-69 OPC items for TF command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].TF.1.FetchTF	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].TF.1.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].TF.1.A1FlowRate	R	VT_R4		Flow rate for first arm
[B].[D].TF.1.A1TargetFlowRate	R	VT_R4		Current target flow rate for first arm
[B].[D].TF.1.A2FlowRate	R	VT_R4		Flow rate for second arm
[B].[D].TF.1.A2TargetFlowRate	R	VT_R4		Current target flow rate for second arm
[B].[D].TF.1.A3FlowRate	R	VT_R4		Flow rate for third arm
[B].[D].TF.1.A3TargetFlowRate	R	VT_R4		Current target flow rate for third arm
[B].[D].TF.1.A4FlowRate	R	VT_R4		Flow rate for fourth arm
[B].[D].TF.1.A4TargetFlowRate	R	VT_R4		Current target flow rate for fourth arm
[B].[D].TF.1.BayNum	R	VT_UI2		Bay number
[B].[D].TF.1.FirstArmNum	R	VT_UI2		First arm number
[B].[D].TF.1.TotalArms	R	VT_UI2		Number of arms

14.4.31.2 Actual and Current Target Flow for Particular Flow Meter

TABLE 14-69 lists the OPC items for the TF command, whereby the actual and current target flows for a particular flow meter are retrieved.

REMARK: In the OPC items listed in TABLE 14-56 [n] indicates the flow meter number and can be 1 to 4.

TABLE 14-70 OPC items for TF command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].TF.M[n].FetchTF	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].TF.M[n].DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].TF.M[n].FlowRate	R	VT_R4		Flow rate for first arm
[B].[D].TF.M[n].TargetFlowRate	R	VT_R4		Current target flow rate for first arm

14.4.32 Type of Instrument - TI

TAS/OPC client can retrieve the type of the device by issuing the TI command.

REMARK: The TI command can only be used while the device is in the idle state.

TABLE 14-71 lists the OPC items for the TI command.

TABLE 14-71 OPC items for TI command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].TI.FetchTI	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].TI.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].TI.AnalogOP	R	VT_UI2		4-20 mA outputs available
[B].[D].TI.InstCode	R	VT_BSTR		Device code
[B].[D].TI.RIT	R	VT_UI2		RIT panel
[B].[D].TI.TotalArms	R	VT_UI2		Number of arms
[B].[D].TI.TotalCOMPorts	R	VT_UI2		Number of communications ports
[B].[D].TI.TotalInternalAdditiveInjectors	R	VT_UI2		Number of internal additive injectors
[B].[D].TI.TotalMeters	R	VT_UI2		Number of flow meters

14.4.33 Terminate Transaction - TT

TAS/OPC client can stop a transaction that is currently in progress on the device by issuing the TT command. The command remotely stops a transaction on the device by removing authorisation and forcing it to the disconnect prompt.

REMARK: The TT command can only be used while the transaction is in progress.

TABLE 14-72 lists the OPC items for the TT command.

TABLE 14-72 OPC items for TT command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].TT.WriteTT	RW	VT_UI2	1	Write command flag (1 = Write)
[B].[D].TT.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.4.34 Volume Correction Factor - VC

TAS/OPC client can retrieve the volume correction factor (**C**orrection **T**emperature **P**ressure **L**iquid) for all flow meters from the device by issuing the VC command.

TABLE 14-73 lists the OPC items for the VC command.

TABLE 14-73 OPC items for VC command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].VC.FetchVC	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].VC.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].VC.BayNum	R	VT_UI2		Bay number
[B].[D].VC.FirstMeterNum	R	VT_UI2		Number of first flow meter
[B].[D].VC.M1VCFactor	R	VT_R4		Volume correction factor (CTPL) for first flow meter.
[B].[D].VC.M2VCFactor	R	VT_R4		Volume correction factor (CTPL) for second flow meter.

OPC Item	Access Type	Data Type	Range	Description
[B].[D].VC.M3VCFactor	R	VT_R4		Volume correction factor (CTPL) for third flow meter.
[B].[D].VC.M4VCFactor	R	VT_R4		Volume correction factor (CTPL) for fourth flow meter.
[B].[D].VC.TotalMeters	R	VT_UI2		Number of flow meters

14.4.35 Displaying Messages and Getting Answers

TAS/OPC client can send text messages to the device to inform or prompt the operator, by issuing one of the following commands:

- Display message - DM (see section 14.4.35.3)
- Display prompt - DP (see section 14.4.35.4)
- Get answer - GA (see section 14.4.35.5)
- Get hidden answer - GH (see section 14.4.35.6)
- Get touch key - GK (see section 14.4.35.7)
- Get Nexwatch card - GN (see section 14.4.35.8)
- Get RF ID (GR) (see section 14.4.35.9)
- Clear message - CM (see section 14.4.35.10)

14.4.35.1 Justify Character Options

The commands all have a similar structure and involve the use of a justification character to set the spacing on each line. The justify character is the first character of each parameter of the command.

The justify character options are listed in TABLE 14-74.

TABLE 14-74 Justify Character Options

Justify Character	Description
|	Centre justified (vertical bar,7CH)
_	Left justified (underscore, 5FH)
+	Right justified (plus, 2BH)
0 to 30	A number between 0 and 30 in the justify field will justify the text that number of spaces from the left (must be two characters, i.e. 03 for 3 spaces).

14.4.35.2 Message Options

The device has an 8 line x 30 character display. However, because meter totals must remain on the screen at most times it is not always possible to display 8 lines. A message of 8 lines can be displayed only during the idle, RA or RL state. Load Scheduling mode messages can be displayed only during the idle, RA, RC, and PL states. In RC and PL states the device can display messages of only two lines. These two line messages are displayed on the bottom two lines of the display. Two line messages should contain either '-1' or '-2' for the first six line parameters.

The message options are listed in TABLE 14-75.

TABLE 14-75 Message Options

Message Option	Description
-1	Leave line as is (if previous message still being displayed)
-2	Clear line (if previous message still being displayed)

14.4.35.3 Display Message - DM

The Display Message (DM) command allows TAS/OPC client to display a message on the device without requiring a response from the operator.

After the device received the DM command, the response of the device to the ENQ command is DM.

After using the DM command, TAS/OPC client can return the device to its original display by issuing the Clear Message (CM) command.

The DM command can only be used for full screen messaging when the device is in the idle, RA or RL state. The RL and RA states requiring Load Scheduling and Remote Authorise respectively to be enabled.

TABLE 14-76 lists the OPC items for the DM command.

TABLE 14-76 OPC Items for Display Message (DM) Command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].DM.Line1	RW	VT_BSTR	0 to 33	Text + display parameter line 1 (Range is 0 to 33)
[B].[D].DM.Line2	RW	VT_BSTR	0 to 33	Text + display parameter line 2 (Range is 0 to 33)
[B].[D].DM.Line3	RW	VT_BSTR	0 to 33	Text + display parameter line 3
[B].[D].DM.Line4	RW	VT_BSTR	0 to 33	Text + display parameter line 4 (Range is 0 to 33)
[B].[D].DM.Line5	RW	VT_BSTR	0 to 33	Text + display parameter line 5 (Range is 0 to 33)
[B].[D].DM.Line6	RW	VT_BSTR	0 to 33	Text + display parameter line 6 (Range is 0 to 33)
[B].[D].DM.Line7	RW	VT_BSTR	0 to 33	Text + display parameter line 7 (Range is 0 to 33)

OPC Item	Access Type	Data Type	Range	Description
[B].[D].DM.Line8	RW	VT_BSTR	0 to 33	Text + display parameter line 8 (Range is 0 to 33)
[B].[D].DM.WriteDM	RW	VT_UI2	1	Write command flag (1 = Write)
[B].[D].DM.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.4.35.4 Display Prompt - DP

The Display Prompt (DP) command allows TAS/OPC client to display a message on the device prompting the operator to press the Enter/Yes key.

After the device received the DP command, the response of the device to the ENQ command is DP. After the operator answers the message, the device displays 'PLEASE WAIT'. The response of the device to the ENQ command from the computer is MT (Message Taken).

After using the DP command, TAS/OPC client can return the device to its original display by issuing the Clear Message (CM) command. To automatically clear the message, TAS/OPC client can send an automatic timeout period as part of the DP command.

The DP command can only be used for full screen messaging when the device is in the idle, AR, PL, RA, RC or RL state. The RL and RA states requiring Load Scheduling and Remote Authorise respectively to be enabled.

TABLE 14-77 lists the OPC items for the DP command.

TABLE 14-77 OPC items for Display Prompt (DP) command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].DP.Line1	RW	VT_BSTR	0 to 33	Text + display parameter line 1 (Range is 0 to 33)
[B].[D].DP.Line2	RW	VT_BSTR	0 to 33	Text + display parameter line 2 (Range is 0 to 33)
[B].[D].DP.Line3	RW	VT_BSTR	0 to 33	Text + display parameter line 3
[B].[D].DP.Line4	RW	VT_BSTR	0 to 33	Text + display parameter line 4 (Range is 0 to 33)
[B].[D].DP.Line5	RW	VT_BSTR	0 to 33	Text + display parameter line 5 (Range is 0 to 33)
[B].[D].DP.Line6	RW	VT_BSTR	0 to 33	Text + display parameter line 6 (Range is 0 to 33)

OPC Item	Access Type	Data Type	Range	Description
[B].[D].DP.Line7	RW	VT_BSTR	0 to 33	Text + display parameter line 7 (Range is 0 to 33)
[B].[D].DP.Line8	RW	VT_BSTR	0 to 33	Text + display parameter line 8 (Range is 0 to 33)
[B].[D].DP.MsgTimeout	RW	VT_UI2		Message timeout [seconds]
[B].[D].DP.WriteDP	RW	VT_UI2	1	Write command flag (1 = Write)
[B].[D].DP.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.4.35.5 Get Answer GA

The Get Answer GA command allows TAS/OPC client to display a message on the device prompting the operator enter an answer. The operator must answer by either entering a number and pressing Enter, or by pressing the Yes, No, Display, ALPHA/LINE, or START keys.

After the device receives the GA command, the response of the device to the ENQ command is GA. After the operator answers the message, the device displays 'PLEASE WAIT'. The response of the device to the ENQ command from the computer is AA (Answer Available).

After using the GA command, TAS/OPC client can return the device to its original display by issuing the Clear Message (CM) command.

The GA command can only be used for full screen messaging when the device is in the idle, AR, PL, RA, RC or RL state. The RL and RA states requiring Load Scheduling and Remote Authorise respectively to be enabled.

TABLE 14-78 lists the OPC items for the GA command.

TABLE 14-78 OPC items for Get Answer (GA) command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].GA.Line1	RW	VT_BSTR	0 to 33	Text + display parameter line 1 (Range is 0 to 33)
[B].[D].GA.Line2	RW	VT_BSTR	0 to 33	Text + display parameter line 2 (Range is 0 to 33)
[B].[D].GA.Line3	RW	VT_BSTR	0 to 33	Text + display parameter line 3
[B].[D].GA.Line4	RW	VT_BSTR	0 to 33	Text + display parameter line 4 (Range is 0 to 33)

OPC Item	Access Type	Data Type	Range	Description
[B].[D].GA.Line5	RW	VT_BSTR	0 to 33	Text + display parameter line 5 (Range is 0 to 33)
[B].[D].GA.Line6	RW	VT_BSTR	0 to 33	Text + display parameter line 6 (Range is 0 to 33)
[B].[D].GA.Line7	RW	VT_BSTR	0 to 33	Text + display parameter line 7 (Range is 0 to 33)
[B].[D].GA.Line8	RW	VT_BSTR	0 to 33	Text + display parameter line 8 (Range is 0 to 33)
[B].[D].GA.WriteGA	RW	VT_UI2	1	Write command flag (1 = Write)
[B].[D].GA.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.4.35.6 Get Hidden - GH

The Get Hidden (GH) command allows TAS/OPC client to display a message on the display of the device prompting the operator enter a PIN or password. The operator must answer by either entering a number and pressing Enter, or by pressing the Yes, No, Display, ALPHA/LINE, or START keys. To provide security each key press displays an asterisk.

After the device received the GH command, the response of device to the ENQ command is GH. After the operator answers the message, the device displays the answer and 'PLEASE WAIT'. The response of the device to the ENQ command from the computer is AA (Answer Available).

After using the GH command, TAS/OPC client can return the device to its original display by issuing the Clear Message (CM) command.

The GH command can only be used for full screen messaging when the device is in the idle, AR, PL, RA, RC or RL state. The RL and RA states requiring Load Scheduling and Remote Authorise respectively to be enabled.

TABLE 14-79 lists the OPC items for the GH command.

TABLE 14-79 OPC items for Get Hidden (GH) command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].GH.Line1	RW	VT_BSTR	0 to 33	Text + display parameter line 1 (Range is 0 to 33)

OPC Item	Access Type	Data Type	Range	Description
[B].[D].GH.Line2	RW	VT_BSTR	0 to 33	Text + display parameter line 2 (Range is 0 to 33)
[B].[D].GH.Line3	RW	VT_BSTR	0 to 33	Text + display parameter line 3
[B].[D].GH.Line4	RW	VT_BSTR	0 to 33	Text + display parameter line 4 (Range is 0 to 33)
[B].[D].GH.Line5	RW	VT_BSTR	0 to 33	Text + display parameter line 5 (Range is 0 to 33)
[B].[D].GH.Line6	RW	VT_BSTR	0 to 33	Text + display parameter line 6 (Range is 0 to 33)
[B].[D].GH.Line7	RW	VT_BSTR	0 to 33	Text + display parameter line 7 (Range is 0 to 33)
[B].[D].GH.Line8	RW	VT_BSTR	0 to 33	Text + display parameter line 8 (Range is 0 to 33)
[B].[D].GH.WriteGH	RW	VT_UI2	1	Write command flag (1 = Write)
[B].[D].GH.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.4.35.7 Get Touch Key - GK

If a touch key is fitted to the device the Get Touch Key (GK) command allows TAS/OPC client to display a message on the display of the device prompting the operator to touch his/her key.

After the device received the GK command, the response of the device to the ENQ command is GK. After the message is acknowledged by the operator the response of the device to the ENQ command from the computer is KA (Touch Key Available).

After using the GK command, TAS/OPC client can return the device to its original display by issuing the Clear Message (CM) command.

The GK command can only be used for full screen messaging when the device is in the idle, AR, PL, RA, RC or RL state. The RL and RA states requiring Load Scheduling and Remote Authorise respectively to be enabled.

TABLE 14-80 lists the OPC items for the GK command.

TABLE 14-80 OPC items for Get Touch Key (GK) command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].GK.Line1	RW	VT_BSTR	0 to 33	Text + display parameter line 1 (Range is 0 to 33)
[B].[D].GK.Line2	RW	VT_BSTR	0 to 33	Text + display parameter line 2 (Range is 0 to 33)
[B].[D].GK.Line3	RW	VT_BSTR	0 to 33	Text + display parameter line 3
[B].[D].GK.Line4	RW	VT_BSTR	0 to 33	Text + display parameter line 4 (Range is 0 to 33)
[B].[D].GK.Line5	RW	VT_BSTR	0 to 33	Text + display parameter line 5 (Range is 0 to 33)
[B].[D].GK.Line6	RW	VT_BSTR	0 to 33	Text + display parameter line 6 (Range is 0 to 33)
[B].[D].GK.Line7	RW	VT_BSTR	0 to 33	Text + display parameter line 7 (Range is 0 to 33)
[B].[D].GK.Line8	RW	VT_BSTR	0 to 33	Text + display parameter line 8 (Range is 0 to 33)
[B].[D].GK.WriteGK	RW	VT_UI2	1	Write command flag (1 = Write)
[B].[D].GK.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.4.35.8 Get NexWatch Card - GN

If a touch key is fitted to the device the Get NexWatch Card (GN) command allows TAS/OPC client to display a message on the display of the device prompting the operator to present his/her card.

After the device received the GN command, the response of the device to the ENQ command is GN. After the message is acknowledged by the operator the response of the device to the ENQ command from the computer is NA (NexWatch Card Available).

After using the GN command, TAS/OPC client can return the device to its original display by issuing the Clear Message (CM) command.

The GN command can only be used for full screen messaging when the device is in the idle, AR, PL, RA, RC or RL state. The RL and RA states requiring Load Scheduling and Remote Authorise respectively to be enabled.

TABLE 14-81 lists the OPC items for the GN command.

TABLE 14-81 OPC items for Get NexWatch Card (GN) command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].GN.Line1	RW	VT_BSTR	0 to 33	Text + display parameter line 1 (Range is 0 to 33)
[B].[D].GN.Line2	RW	VT_BSTR	0 to 33	Text + display parameter line 2 (Range is 0 to 33)
[B].[D].GN.Line3	RW	VT_BSTR	0 to 33	Text + display parameter line 3
[B].[D].GN.Line4	RW	VT_BSTR	0 to 33	Text + display parameter line 4 (Range is 0 to 33)
[B].[D].GN.Line5	RW	VT_BSTR	0 to 33	Text + display parameter line 5 (Range is 0 to 33)
[B].[D].GN.Line6	RW	VT_BSTR	0 to 33	Text + display parameter line 6 (Range is 0 to 33)
[B].[D].GN.Line7	RW	VT_BSTR	0 to 33	Text + display parameter line 7 (Range is 0 to 33)
[B].[D].GN.Line8	RW	VT_BSTR	0 to 33	Text + display parameter line 8 (Range is 0 to 33)
[B].[D].GN.WriteGN	RW	VT_UI2	1	Write command flag (1 = Write)
[B].[D].GN.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.4.35.9 Get RF ID - GR

If a touch key is fitted to the device the Get RF ID (GR) command allows TAS/OPC client to display a message on the display of the device prompting the operator to present his/her card.

After the device received the GR command, the response of the device to the ENQ command is GR. After the RFID is read the response changes FA (RF ID Available).

After using the GR command, TAS/OPC client can return the device to its original display by issuing the Clear Message (CM) command.

The GR command can only be used for full screen messaging when the device is in the idle, RA or RL state. The RL and RA states requiring Load Scheduling and Remote Authorise respectively to be enabled.

TABLE 14-82 lists the OPC items for the GR command.

TABLE 14-82 OPC items for Get RF ID (GR) command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].GR.Line1	RW	VT_BSTR	0 to 33	Text + display parameter line 1 (Range is 0 to 33)
[B].[D].GR.Line2	RW	VT_BSTR	0 to 33	Text + display parameter line 2 (Range is 0 to 33)
[B].[D].GR.Line3	RW	VT_BSTR	0 to 33	Text + display parameter line 3
[B].[D].GR.Line4	RW	VT_BSTR	0 to 33	Text + display parameter line 4 (Range is 0 to 33)
[B].[D].GR.Line5	RW	VT_BSTR	0 to 33	Text + display parameter line 5 (Range is 0 to 33)
[B].[D].GR.Line6	RW	VT_BSTR	0 to 33	Text + display parameter line 6 (Range is 0 to 33)
[B].[D].GR.Line7	RW	VT_BSTR	0 to 33	Text + display parameter line 7 (Range is 0 to 33)
[B].[D].GR.Line8	RW	VT_BSTR	0 to 33	Text + display parameter line 8 (Range is 0 to 33)
[B].[D].GR.WriteGR	RW	VT_UI2	1	Write command flag (1 = Write)
[B].[D].GR.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.4.35.10 Clear Message - CM

The Clear Message (CM) command enables TAS/OPC client to return the device to its original display after using the DM, DP, GA, GH, GK, GN or GR command.

TABLE 14-83 lists the OPC items for the CM command.

TABLE 14-83 OPC items for Clear Message (CM) command

OPC Item	Access Type	Data Type	Range	Description
[B].[D].CM.WriteCM	RW	VT_UI2		Write command flag (1 = Write)
[B].[D].CM.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.4.35.11 Answer Available - AA

TABLE 14-84 lists the OPC items for Answer Available.

TABLE 14-84 OPC items for Answer Available (AA)

OPC Item	Access Type	Data Type	Range	Description
[B].[D].AA.OperRes	R	VT_BSTR		Answer of GA or GH command

14.5 Alarms

If Fusion4 OPC server detects one or more alarms on a device it will collect these alarms and update the relevant alarm OPC items. When the error is recovered TAS/OPC client can acknowledge the alarm condition by resetting alarms.

14.5.1 Types of Alarms

Fusion4 will retrieve alarm conditions from the connected device(s) automatically when occurred. Following are type of alarms that any TAS/ OPC client can monitor:

- System (see section 14.5.1.2)
- Meters (see section 14.5.1.3)
- Loading arms (see section 14.5.1.4)
- Additive injection (see section 14.5.1.5)
- Recipes (see section 14.5.1.6)

14.5.1.1 Fetching Alarms on Demand

Fusion4 OPC items for alarms needs to be subscribed in order to scan relevant details from 1010CB. If TAS/ OPC Client requires alarms information on demand without subscription then it has to perform a write operation on [B].[D].Alm.FetchAlm.

OPC Item	Access Type	Data Type	Range	Description
[B].[D].Alm.FetchAlm	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].Alm.DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.5.1.2 System Alarms

In TABLE 14-85 the OPC items concerning system alarms are listed.

TABLE 14-85 OPC items concerning system alarms

OPC Item	Access Type	Data Type	Range	Description
[B].[D].Alm.FetchSysAlm	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].Alm.SysDevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].Alm.Assert	RW	VT_BOOL		System Alarm - Assert
[B].[D].Alm.CalbrationFactorChanged	RW	VT_BOOL		System Alarm - Calibration Factor Changed
[B].[D].Alm.CommAlm	RW	VT_BOOL		System Alarm - Communication Alarm
[B].[D].Alm.COMPortNotAssignedIntelligentAdditive	RW	VT_BOOL		System Alarm - Comport not assigned to Intelligent Additive
[B].[D].Alm.COMPortNotAssignedNexWatch	RW	VT_BOOL		System Alarm - Comport not assigned to NexWatch
[B].[D].Alm.CPUAddress	RW	VT_BOOL		System Alarm - CPU Address
[B].[D].Alm.CriticalDataCorrupt	RW	VT_BOOL		System Alarm - Critical data Corrupt
[B].[D].Alm.Custom1	RW	VT_BOOL		System Alarm - Custom alarm 1
[B].[D].Alm.DeadManBell	RW	VT_BOOL		System Alarm - Deadman Bell
[B].[D].Alm.DeadManCallout	RW	VT_BOOL		System Alarm - Deadman Callout
[B].[D].Alm.DeadManIndicator	RW	VT_BOOL		System Alarm - Deadman Indicator
[B].[D].Alm.DispFail	RW	VT_BOOL		System Alarm - Display Failure
[B].[D].Alm.EarthOverfillDisconnect	RW	VT_BOOL		System Alarm - Overfill Disconnected
[B].[D].Alm.EmergencyStop	RW	VT_BOOL		System Alarm - Emergency Stop
[B].[D].Alm.IllegalInstruction	RW	VT_BOOL		System Alarm - Illegal Instruction

OPC Item	Access Type	Data Type	Range	Description
[B].[D].Alm.InstrumentCorrupt	RW	VT_BOOL		System Alarm - Instrument type corrupt
[B].[D].Alm.MngrReset	RW	VT_BOOL		System Alarm - MPK Reserved
[B].[D].Alm.Multiple100ms	RW	VT_BOOL		System Alarm - Multiple 100ms
[B].[D].Alm.NexWatchComm	RW	VT_BOOL		System Alarm - NexWatch Communications
[B].[D].Alm.PrgDiscon	RW	VT_BOOL		System Alarm - Program Disconnection
[B].[D].Alm.PwrFail	RW	VT_BOOL		System Alarm - Power Failure
[B].[D].Alm.RAMCorruption	RW	VT_BOOL		System Alarm - RAM corruption
[B].[D].Alm.ReprogramFlash	RW	VT_BOOL		System Alarm - Reprogram Flash
[B].[D].Alm.ReprogramInProgress	RW	VT_BOOL		System Alarm - Reprogramming in Progress
[B].[D].Alm.SDFClr	RW	VT_BOOL		System Alarm - SDF Cleared
[B].[D].Alm.SDFDataCorrup	RW	VT_BOOL		System Alarm - SDF Data corruption
[B].[D].Alm.SDFFail	RW	VT_BOOL		System Alarm - SDF Failure
[B].[D].Alm.Spare1	RW	VT_BOOL		System Alarm - Spare alarm 1
[B].[D].Alm.Spare2	RW	VT_BOOL		System Alarm - Spare alarm 2
[B].[D].Alm.Spare3	RW	VT_BOOL		System Alarm - Spare alarm 3
[B].[D].Alm.Spare4	RW	VT_BOOL		System Alarm - Spare alarm 4
[B].[D].Alm.Spare5	RW	VT_BOOL		System Alarm - Spare alarm 5
[B].[D].Alm.SysFlt	RW	VT_BOOL		System Alarm - System Corruption
[B].[D].Alm.SysStack	RW	VT_BOOL		System Alarm - System Stack
[B].[D].Alm.SystemInput1Disconnected	RW	VT_BOOL		System Alarm - System input 1 disconnected
[B].[D].Alm.SystemInput2Disconnected	RW	VT_BOOL		System Alarm - System input 2 disconnected

OPC Item	Access Type	Data Type	Range	Description
[B].[D].Alm.SystemInput3Disconnected	RW	VT_BOOL		System Alarm - System input 3 disconnected
[B].[D].Alm.SystemInput4Disconnected	RW	VT_BOOL		System Alarm - System input 4 disconnected
[B].[D].Alm.SystemInput5Disconnected	RW	VT_BOOL		System Alarm - System input 5 disconnected
[B].[D].Alm.SystemInput6Disconnected	RW	VT_BOOL		System Alarm - System input 6 disconnected
[B].[D].Alm.SysTrap	RW	VT_BOOL		System Alarm - System Trap
[B].[D].Alm.TransStoreFull	RW	VT_BOOL		System Alarm - Transaction storage Full
[B].[D].Alm.UsrAlmA	RW	VT_BOOL		System Alarm - User alarm A
[B].[D].Alm.UsrAlmB	RW	VT_BOOL		System Alarm - User alarm B
[B].[D].Alm.UsrAlmC	RW	VT_BOOL		System Alarm - User alarm C
[B].[D].Alm.UsrAlmD	RW	VT_BOOL		System Alarm - User alarm D
[B].[D].Alm.VapourDisconnected	RW	VT_BOOL		System Alarm - Vapor Disconnected
[B].[D].Alm.WatchDog	RW	VT_BOOL		System Alarm - Watchdog

14.5.1.3 Flow Meter Alarms

In TABLE 14-86 the OPC items concerning flow meter alarms are listed.

REMARK: In the OPC items listed in TABLE 14-86 [n] indicates the flow meter number and can be 1 to 4.

TABLE 14-86 OPC items concerning flow meter alarms

OPC Item	Access Type	Data Type	Range	Description
[B].[D].Alm.M[n].FetchAlm	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].Alm.M[n].DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

OPC Item	Access Type	Data Type	Range	Description
[B].[D].Alm.M[n].CalculationNoSolution	RW	VT_BOOL		Meter Alarm - Calculation No solution
[B].[D].Alm.M[n].DensityBadPV	RW	VT_BOOL		Meter Alarm - Density or Exp. co-efficientOut of Range
[B].[D].Alm.M[n].DensitFault	RW	VT_BOOL		Meter Alarm - Density Probe
[B].[D].Alm.M[n].IllegalArgument	RW	VT_BOOL		Meter Alarm - Illegal Argument
[B].[D].Alm.M[n].MtrError	RW	VT_BOOL		Meter Alarm - Dual pulse
[B].[D].Alm.M[n].MtrIllegalFlow	RW	VT_BOOL		Meter Alarm - Unauthorized flow
[B].[D].Alm.M[n].MtrTimeout	RW	VT_BOOL		Meter Alarm - No flow timeout
[B].[D].Alm.M[n].NonConvergence	RW	VT_BOOL		Meter Alarm - Non-convergence
[B].[D].Alm.M[n].NoReferenceFluid	RW	VT_BOOL		Meter Alarm - No Reference Fluid
[B].[D].Alm.M[n].Pharror	RW	VT_BOOL		Meter Alarm - Phase error
[B].[D].Alm.M[n].PressureBadPV	RW	VT_BOOL		Meter Alarm - Pressure Out of Range
[B].[D].Alm.M[n].PressureFault	RW	VT_BOOL		Meter Alarm - Pressure Probe
[B].[D].Alm.M[n].Spare1	RW	VT_BOOL		Meter Alarm - Spare Alarm 1
[B].[D].Alm.M[n].Spare2	RW	VT_BOOL		Meter Alarm - Spare Alarm 2
[B].[D].Alm.M[n].Spare3	RW	VT_BOOL		Meter Alarm - Spare Alarm 3
[B].[D].Alm.M[n].Spare4	RW	VT_BOOL		Meter Alarm - Spare Alarm 4
[B].[D].Alm.M[n].Spare5	RW	VT_BOOL		Meter Alarm - Spare Alarm 5
[B].[D].Alm.M[n].Spare6	RW	VT_BOOL		Meter Alarm - Spare Alarm 6
[B].[D].Alm.M[n].Spare7	RW	VT_BOOL		Meter Alarm - Spare Alarm 7
[B].[D].Alm.M[n].SupercriticalFluid	RW	VT_BOOL		Meter Alarm - Supercritical Fluid
[B].[D].Alm.M[n].tempBadPV	RW	VT_BOOL		Meter Alarm - Temperature Out of Range
[B].[D].Alm.M[n].tempFault	RW	VT_BOOL		Meter Alarm - Temperature probe
[B].[D].Alm.M[n].ValveFault	RW	VT_BOOL		Meter Alarm - Valve fault
[B].[D].Alm.M[n].VolCorrectionOutOfRange	RW	VT_BOOL		Meter Alarm - Volume correction factor (CTPL) Out of Range

14.5.1.4 Loading Arm Alarms

In TABLE 14-87 the OPC items concerning loading arm alarms are listed.

REMARK: In the OPC items listed in TABLE 14-87 [n] indicates the loading arm number and can be 1 to 4 based on the sales code. See section 14.1.8

TABLE 14-87 OPC items concerning loading arm alarms

OPC Item	Access Type	Data Type	Range	Description
[B].[D].Alm.A[n].FetchAlm	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].Alm.A[n].BlendErrorHigh	RW	VT_BOOL		Arm Alarm - Blend error High
[B].[D].Alm.A[n].BlendErrorLow	RW	VT_BOOL		Arm Alarm - Blend error Low
[B].[D].Alm.A[n].Input1Disconnected	RW	VT_BOOL		Arm Alarm - Arm input 1 disconnected
[B].[D].Alm.A[n].Input2Disconnected	RW	VT_BOOL		Arm Alarm - Arm input 2 disconnected
[B].[D].Alm.A[n].Input3Disconnected	RW	VT_BOOL		Arm Alarm - Arm input 3 disconnected
[B].[D].Alm.A[n].Input4Disconnected	RW	VT_BOOL		Arm Alarm - Arm input 4 disconnected
[B].[D].Alm.A[n].Input5Disconnected	RW	VT_BOOL		Arm Alarm - Arm input 5 disconnected
[B].[D].Alm.A[n].Input6Disconnected	RW	VT_BOOL		Arm Alarm - Arm input 6 disconnected
[B].[D].Alm.A[n].Input7Disconnected	RW	VT_BOOL		Arm Alarm - Arm input 7 disconnected
[B].[D].Alm.A[n].Input8Disconnected	RW	VT_BOOL		Arm Alarm - Arm input 8 disconnected
[B].[D].Alm.A[n].LeakingBlendStream	RW	VT_BOOL		Arm Alarm - Leaking Blend Stream
[B].[D].Alm.A[n].MtrHiFlow1	RW	VT_BOOL		Arm Alarm - Slow flow High
[B].[D].Alm.A[n].MtrHiFlow2	RW	VT_BOOL		Arm Alarm - High flow High
[B].[D].Alm.A[n].MtrHiFlow3	RW	VT_BOOL		Arm Alarm - Low flow High
[B].[D].Alm.A[n].MtrLoFlow1	RW	VT_BOOL		Arm Alarm - Slow flow Low
[B].[D].Alm.A[n].MtrLoFlow2	RW	VT_BOOL		Arm Alarm - High flow Low
[B].[D].Alm.A[n].MtrLoFlow3	RW	VT_BOOL		Arm Alarm - Low flow Low
[B].[D].Alm.A[n].RemoteStop	RW	VT_BOOL		Arm Alarm - Remote Stop
[B].[D].Alm.A[n].RemoteTerminate	RW	VT_BOOL		Arm Alarm - Remote Terminate
[B].[D].Alm.A[n].Spare1	RW	VT_BOOL		Arm Alarm - Spare alarm 1
[B].[D].Alm.A[n].Spare2	RW	VT_BOOL		Arm Alarm - Spare alarm 2
[B].[D].Alm.A[n].Spare3	RW	VT_BOOL		Arm Alarm - Spare alarm 3
[B].[D].Alm.A[n].Spare4	RW	VT_BOOL		Arm Alarm - Spare alarm 4
[B].[D].Alm.A[n].Spare5	RW	VT_BOOL		Arm Alarm - Spare alarm 5

OPC Item	Access Type	Data Type	Range	Description
[B].[D].Alm.A[n].DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.5.1.5 Additive Injection Alarms

In TABLE 14-88 the OPC items concerning additive injection alarms are listed.

REMARK: In the OPC items listed in TABLE 14-88 [n] indicates the additive injection point number and can be 1 to 24.

TABLE 14-88 OPC items concerning additive injection alarms

OPC Item	Access Type	Data Type	Range	Description
[B].[D].Alm.IP[n].FetchAlm	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].Alm.IP[n].DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].Alm.IP[n].AdditiveCommunicationFailure	RW	VT_BOOL		Additive Alarm - Calibration Factor changed
[B].[D].Alm.IP[n].AdditiveCommunicationResp	RW	VT_BOOL		Additive Alarm - Communications Response (MPK)
[B].[D].Alm.IP[n].AdditiveEEPROMFail	RW	VT_BOOL		Additive Alarm - EEPROM Fail
[B].[D].Alm.IP[n].AdditiveFirmwareFail	RW	VT_BOOL		Additive Alarm - Firmware Fail
[B].[D].Alm.IP[n].AdditiveHigh	RW	VT_BOOL		Additive Alarm - High Additive (Internal Additive)
[B].[D].Alm.IP[n].AdditiveLow	RW	VT_BOOL		Additive Alarm - Low Additive (Internal Additive)
[B].[D].Alm.IP[n].AdditiveMPKReserved	RW	VT_BOOL		Reserved for MiniPAK
[B].[D].Alm.IP[n].AdditiveMeterNoFlow	RW	VT_BOOL		Additive Alarm - No Additive

OPC Item	Access Type	Data Type	Range	Description
[B].[D].Alm.IP[n].AdditiveNoActivity	RW	VT_BOOL		Additive Alarm - No activity
[B].[D].Alm.IP[n].AdditiveNoCommunicationResponse	RW	VT_BOOL		Additive Alarm - Comms Response No (MPK)
[B].[D].Alm.IP[n].AdditiveValvelLeak	RW	VT_BOOL		Additive Alarm - Leaking Additive
[B].[D].Alm.IP[n].AddVolumeTolerance	RW	VT_BOOL		Additive Alarm - Additive Volume Tolerance (MPK)
[B].[D].Alm.IP[n].Spare1	RW	VT_BOOL		Additive Alarm - Spare alarm 1
[B].[D].Alm.IP[n].Spare2	RW	VT_BOOL		Additive Alarm - Spare alarm 2
[B].[D].Alm.IP[n].Spare3	RW	VT_BOOL		Additive Alarm - Spare alarm 3
[B].[D].Alm.IP[n].Spare4	RW	VT_BOOL		Additive Alarm - Spare alarm 4

14.5.1.6 Recipe Alarms

In TABLE 14-89 the OPC items concerning Fusion4 recipe alarms are listed.

REMARK: In the OPC items listed in TABLE 14-89 [n] indicates the recipe number and can be 1 to 16.

TABLE 14-89 OPC items concerning recipe alarms

OPC Item	Access Type	Data Type	Range	Description
[B].[D].Alm.RS[n].FetchAlm	RW	VT_UI2	1	Fetch command flag (1 = Fetch)
[B].[D].Alm.RS[n].DevResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy
[B].[D].Alm.RS[n].DisableAlm	RW	VT_BOOL		Recipe Alarm - Disabled Alarm
[B].[D].Alm.RS[n].HighFlow	RW	VT_BOOL		Recipe Alarm - High Flow alarm
[B].[D].Alm.RS[n].LowFlow	RW	VT_BOOL		Recipe Alarm - Low Flow alarm
[B].[D].Alm.RS[n].SlowFlow	RW	VT_BOOL		Recipe Alarm - Slow Flow alarm
[B].[D].Alm.RS[n].Spare1	RW	VT_BOOL		Recipe alarm - Spare alarm 1
[B].[D].Alm.RS[n].Spare2	RW	VT_BOOL		Recipe alarm - Spare alarm 2

OPC Item	Access Type	Data Type	Range	Description
[B].[D].Alm.RS[n].Spare3	RW	VT_BOOL		Recipe alarm - Spare alarm 3
[B].[D].Alm.RS[n].Spare4	RW	VT_BOOL		Recipe alarm - Spare alarm 4

14.5.2 Resetting Alarms

TAS/OPC client can reset alarms on the 1010CB.

14.5.2.1 Resetting All Alarms

TABLE 14-91 lists the OPC items relating to resetting all alarms.

TABLE 14-90 OPC items relating to resetting all alarms

OPC Item	Access Type	Data Type	Range	Description
[B].[D].Alm.Reset	RW	VT_UI2	1	Reset all alarms command flag (1 = Reset)
[B].[D].Alm.ResResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.5.2.2 Resetting System Alarms

TABLE 14-91 lists the OPC items relating to resetting system alarms.

TABLE 14-91 OPC items relating to resetting system alarms

OPC Item	Access Type	Data Type	Range	Description
[B].[D].Alm.ResetSysAlms	RW	VT_UI2	1	Reset system alarms command flag (1 = Reset)
[B].[D].Alm.ResetSysAlmsResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.5.2.3 Resetting Flow Meter Alarms

TABLE 14-92 lists the OPC items relating to resetting flow meter alarms.

TABLE 14-92 OPC items relating to resetting flow meter alarms

OPC Item	Access Type	Data Type	Range	Description
[B].[D].Alm.ResetMtrAlms	RW	VT_UI2	1	Reset meter alarms command flag (1 = Reset)
[B].[D].Alm.ResetMtrAlmsResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.5.2.4 Resetting Loading Arm Alarms

TABLE 14-93 lists the OPC items relating to resetting loading arm alarms.

TABLE 14-93 OPC Items for Resetting Loading Arm Alarms

OPC Item	Access Type	Data Type	Range	Description
[B].[D].Alm.ResetArmAlms	RW	VT_UI2	1	Reset arm alarms command flag (1 = Reset)
[B].[D].Alm.ResetArmAlmsResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.5.2.5 Resetting Additive Injection Alarms

TABLE 14-94 lists the OPC items relating to resetting additive injection alarms.

TABLE 14-94 OPC items relating to resetting additive injection alarms

OPC Item	Access Type	Data Type	Range	Description
[B].[D].Alm.ResetAdditiveAlms	RW	VT_UI2	1	Reset additive alarms command flag (1 = Reset)
[B].[D].Alm.ResetAdditiveAlmsResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.5.2.6 Resetting Recipe Alarms

TABLE 14-95 lists the OPC item relating to resetting recipe alarms.

TABLE 14-95 OPC items relating to resetting recipe alarms

OPC Item	Access Type	Data Type	Range	Description
[B].[D].Alm.ResetRecipeAlms	RW	VT_UI2	1	Reset recipe alarms command flag (1 = Reset)
[B].[D].Alm.ResetRecipeAlmsResp	R	VT_UI2		Device reply to SLIP command: 0 = None 1 = ACK 2 = NAK 3 = Busy

14.5.2.7 Resetting Individual Alarms

TAS/OPC client can reset each alarm individually by writing into the particular alarm OPC item. For example: To reset the dead man bell alarm, TAS/OPC client can write False to [B].[D].Alm.DeadManBell.

14.6 Diagnostics

Fusion4 OPC Server will log messages at some events. These can be viewed from the *Log Viewer* application.

14.6.1 Application Log Events

TABLE 14-96 lists the application log events logged by Fusion4 OPC Server.

TABLE 14-96 Application Log Events

Application Log Event	Occurs when
Fusion4 OPC Server client 2 connected successfully.Total client connections is 2.	Any TAS/ OPC Client establishes a new OPC connection.
Fusion4 OPC Server client 2 disconnected. Total client connections is 1.	One of the connected TAS/ OPC Client terminates OPC connection.
Terminal Automation System is online.	TAS/ OPC Client set Sys.TASStatus to suitable value as connected.
Terminal Automation System is offline.	TAS/ OPC Client sets Sys.TASStatus to suitable value as disconnected.
Scan for CM is not dispatched due to invalid input.	TAS/ OPC Client sets [B].[D].CM.WriteCM value other than 1.

Application Log Event	Occurs when
Scan for TC is not dispatched due to invalid input	TAS/ OPC Client sets [B].[D].Load.TransComplete value other than 1.
Error while scanning STX:RL with N, Deny_Message on device Bay1_1010 at port [COM] :NO_ERROR(NAK = NAK)	IF NAK received is from 1010 CB for RL command.
Error while scanning STX:RA with N, Deny_Message on device Bay1_1010 at port [COM] :NO_ERROR(NAK = NAK)	IF NAK is received from 1010 CB for RAC command.
Error while scanning STX:RC with N, Deny_Message on device Bay1_1010 at port [COM] :NO_ERROR(NAK = NAK)	IF NAK is received from 1010 CB for RC command.

14.6.2 Audit Log Events

TABLE 14-97 lists the audit log events logged by Fusion4 OPC Server.

TABLE 14-97 Audit Log Events

Audit Log Event	Occurs when
Fusion4 Portal started	Fusion4 OPC Server starts.
Fusion4 Portal ended	Fusion4 OPC server ends.
Communication alive on device [D] at [COM]	TAS/ OPC Clients sets [B].[D].DeviceScanDisable to ‘False’ (Killed to Alive).
Communication killed manually on device [D] at [COM].	TAS/ OPC Clients sets [B].[D].DeviceScanDisable to ‘True’ (Alive to Killed).
Product density for meter [Meter] on device [D] at [COM] is set to <Value>.	TAS/OPC client sets density to manual value using [B].[D].DN.RefDens.
Power failure flag on device [D] at [COM] has been reset by CC command.	TAS/ OPC Clients sets [B].[D].CC.WriteCC value as 1.
Name of meter number [M_old] is changed to [M_NewName] on device [D] at [COM] by MN command.	TAS/ OPC Client sets [B].[D].MN.MeterNum value as <num>.
Manager reset done on device [D] at [COM] from Fusion4 OPC Server by MR command.	TAS/ OPC Client sets [B].[D].MR.WriteMR value as 1.
Instrument’s date and time have been set to date [ddmmyyyy] and time [hhmmss] on device [D] at [COM] by RD command.	TAS/ OPC client sets date and time using RD OPC items.
Stop or pause has been done on load/ batch on arm number [Arm_Num] on device [D] at [COM] by SM command.	TAS/ OPC client issues stop/ pause on load/ batch on arm using SM OPC items.

Audit Log Event	Occurs when
Transaction has been settled for transaction number [Trans_Num] on device [D] at [COM] by TS command.	TAS/ OPC Client settles a transaction using TS OPC items.
Transaction number [Trans_Num] that is currently in progress on device [D] at [COM] has been stopped by TT command.	TAS/ OPC Client terminates transaction using TT OPC items.
Download of blend/additive recipes has been done to the instrument on device [D] at [COM] by BR command.	TAS/ OPC Client downloads recipe using BR OPC items.
General Purpose latched inputs for arm [Arm_Num] have been reset on device [D] at [COM] by CL command.	TAS/ OPC Client resets General Purpose inputs for particular arm using CL OPC Items.
General Purpose latched inputs for both arms have been reset on device [D] at [COM] by CL command.	TAS/ OPC Client resets General Purpose inputs for both arms using CL OPC Items.
All General Purpose latched inputs have been reset on device [D] at [COM] by CL command.	TAS/ OPC Client resets General Purpose inputs on device.
General Purpose latched input for [Input_Name] has been reset on device [D] at [COM] by CL command.	TAS/ OPC Client resets a particular General Purpose input.
All arm alarms on Device [D] at [COM] are reset by RT command.	TAS/ OPC Client resets all alarms for each of arms.
All meter alarms on device [D] at [COM] are reset by the RT command.	TAS/ OPC Client resets all alarms for each of meters.
All system alarms on device [D] at [COM] are reset by RT command.	TAS/ OPC Client resets all system alarms.
All recipe alarms on device [D] at [COM] are reset by RT command.	TAS/ OPC Client resets all recipe alarms.
All internal\external additive alarms on device [D] at [COM] are reset by RT command.	TAS/ OPC Client resets all alarms for each of internal/ external additive injectors.
All alarms on device [D] at [COM] are reset by the [RT] command.	TAS/ OPC client resets all alarms.
The [Alarm Name] alarm on device [D] at [COM] for arm [Arm_Num] has been reset.	TAS/ OPC Client resets a particular alarm on a specified arm.
The [Alarm_Name] alarm on device [D] at [COM] for meter [Meter_Num] has been reset.	TAS/ OPC Client resets a particular alarm on a specified meter.
The [Alarm_Name] alarm on device [D] at [COM] for system has been reset.	TAS/ OPC Client resets a particular system alarm.
The [Alarm_Name] alarm on device [D] at [COM] for recipe [RecipeArm_Num] has been reset.	TAS/ OPC Client resets a particular recipe alarm on a specified arm.

Audit Log Event	Occurs when
The [Alarm_Name] alarm on device [D] at [COM] for injection point [Injector Num] has been reset.	TAS/ OPC Client resets a particular injection point alarm on a specified arm.

CHAPTER 15 APPENDICES

15.1 Appendix A: Description of Parameters

15.1.1 Controllers for Additive Injection

TABLE 15-1 describes the parameters for controllers for additive injection (Fusion4 SSC-A and Fusion4 MSC-A).

TABLE 15-1 Description of Parameters for Additive Controllers

Parameter Name	Description
Accumulative additive stream gross observed volume	The accumulative gross observed volume (GOV) of the additive stream excluding leaking additive and additive dispensed during calibration. The measuring unit is unit of volume.
Accumulative calibration gross observed volume	The accumulative gross observed volume (GOV) of the product received in a calibrated vessel over all calibration operations. The measuring unit is unit of volume. To increase the accuracy of the flow meter, a calibration can be performed. This is done by comparing the actual resulting fuel volume received in a calibrated vessel with the displayed value on the screen of the controller, being the result of the value returned from the flow meter. With these two values a correction factor can be calculated, which then is used to (re-) calibrate the flow meter.
Accumulative leaking solenoid gross observed volume	The accumulative gross observed volume (GOV) of leaked additive product as a result of a leaking valve. The measuring unit is unit of volume.
Accumulative load stream gross observed volume	The accumulative gross observed volume (GOV) of the load stream. The measuring unit is unit of volume.
Accumulative total additive stream gross observed volume	The accumulative total gross observed volume (GOV) of the additive stream. The measuring unit is unit of volume.
Accumulative transactional additive stream gross observed volume	The accumulative transactional gross observed volume (GOV) of the additive stream. The measuring unit is unit of volume.
Accumulative wild stream gross observed volume	The accumulative gross observed volume (GOV) of the wild stream. The measuring unit is unit of volume.
Active alarms	Displays all active alarms. See section 15.2.1.8 for more information.

Parameter Name	Description
Additive deviation basis	The number of injection cycles over which the average injection amount will be calculated and be used to determine if a deviation alarm condition exists.
Additive K-factor	The K-factor of the flow meter that measures the additive stream. The measuring unit is pulses per unit of volume.
Additive stream flow rate	The flow rate of the additive stream. The measuring unit is unit of volume per minute.
Additive stream state	The state of the additive stream. See section 15.2.1.7 for more information.
Additive volume deviation alarm action	The alarm behavior in case the Additive volume deviation alarm occurs. See section 15.2.2.2 for more information.
Additive volume deviation allowed	The percentage of additive volume deviation that is accepted without resulting in an alarm situation. If this percentage is exceeded an alarm will occur depending on the setting of the Additive volume deviation alarm action parameter. The alarm will occur at the end of the transaction.
Alarm and permissive state (injectors 1-6)	This parameter contains the stream permissive and alarm states for the first 6 additive streams as a 16-bit bit mask. In this bit mask the least significant bit is the stream permissive status of stream 1 (0 = Unpermitted, 1 = Permitted). The second least significant bit is the alarm status of stream 0 (0 = No alarm, 1 = at least one active alarm). The third and fourth least significant bits represent the same data from additive stream 2. This pattern continues until the 11th and 12th least significant bits for the permissive and alarm status for stream 6. The four most significant bits are unused and will always be zero.
Alarm and permissive state (injectors 7-12)	This parameter contains the stream permissive and alarm states for additive streams 7-12 as a 16-bit bit mask. See the previous parameter for implementation details.
Broadcast address	The ***secondary*** address recognized by the Fusion4 SSC-A. It is not necessarily unique to any particular controller. This address is used by the master if it wants to transmit a command to more than one controller simultaneously. The controller will act upon a message addressed to its own broadcast address, but will not acknowledge it.
Clean start gross observed volume	The minimum amount of volume of main product that must be flushed through piping at the end of a load to ensure that all traces of additive product have been removed from the piping downstream from injection point. The measuring unit is the unit of volume.

Parameter Name	Description
Communications delay port 1	The time between the received request from the master and the moment the answer will be sent. The measuring unit is milliseconds (ms).
Communications delay port 2	'Communications delay port 1'.
Device serial number	The serial number of the device.
DI hysteresis time	The active time of the input signal before accepting it as a valid input signal. So the time between two signal transitions must be greater then the DI hysteresis time. The measuring unit is milliseconds.
Factored pulse output resolution	The number of pulses transmitted for each unit of volume of additive stream flow. See section 15.2.1.5 for more information.
Feedback pulse duration	The duration of the feedback pulse. The measuring unit is milliseconds.
Firmware version number	A six character string used to identify the firmware version number.
Flush volume	The amount of wild stream volume to realize the flushing, by stopping the injections *before the end* of the transaction. The flush volume is the amount of wild stream product that is to remain additive free in order to realize a clean loading arm when the flow stops. The flush volume and Number of clean start cycles determine the additional additive volume to be injected at the start of the transaction ('over injection'). When the flush volume equals zero, the clean arm operation is disabled.
High flow threshold value	The flow rate which must be exceeded to start the injection process during clean arm operation. The measuring unit is unit of volume per minute.
Injection offset	The percentage to determine at what point the controller gives the first injection during a transaction. The percentage is applied to the volume per injection cycle and determines the volume of wild stream product at the moment that the first injection occurs. Subsequent injections occur on the normal volume per injection cycle interval. The Injection offset will guarantee the delivery of the intended additive amount within the complete batch.
Injection volume	The amount of injection volume to be dispensed per injection cycle. The measuring unit is unit of volume.
Leaking solenoid alarm action	The alarm behavior in case the Leaking solenoid alarm occurs. See section 15.2.1.2 for more information.

Parameter Name	Description
Leaking solenoid timeout period	The time in which the leaking solenoid volume limit will be checked. The measuring unit is seconds.
Leaking solenoid volume limit	The maximum amount of additive volume within the leaking solenoid timeout period before the Leaking solenoid alarm is generated. The measuring unit is unit of volume. If the leaking volume limit is exceeded, an alarm will occur depending on the setting of the 'Leaking solenoid alarm action' parameter.
Leaking timeout period	The time in which the leaking volume limit will be checked. The measuring unit is seconds.
Leaking volume limit	The maximum amount of additive volume within the leaking timeout period before a Leaking solenoid' alarm is generated. The measuring unit is unit of volume. If the leaking volume limit is exceeded, an alarm will occur depending on the setting of the Leaking Solenoid Alarm Action parameter.
Load stream flow rate	The flow rate of the load stream. The measuring unit is unit of volume per minute.
Low flow threshold value	The flow rate at which the flushing starts by stopping the additive injection process. The measuring unit is units of volume per minute.
Minimum product volume for transaction	The minimum volume of wild stream that is required for a transaction to start. The measuring unit is unit of volume.
No activity timeout alarm action	The alarm behavior in case the 'No activity' alarm occurs. See section 15.2.1.2 for more information.
No activity timeout period	The time in which wild stream pulses should be received when the controller is permitted. The measuring unit is seconds. When after this time no wild stream pulses have been received, an alarm will occur depending on the setting of the No activity alarm action parameter.
No additive alarm action	The alarm behavior in case the 'No additive' alarm occurs. See section 15.2.1.2 for more information.
No additive flow timeout period	The time in which additive stream pulses should be received when the solenoid is opened. The measuring unit is seconds. When after this time no additive stream pulses have been received after the configured number of retries, an alarm will occur depending on the setting of the 'No additive alarm action' parameter.

Parameter Name	Description
Number of clean start cycles	The number of injection cycles at the start of the transaction to be used for "over injection". This ‘over injection’ at the start compensates the injection stop at the end of the transaction, in order to realize the clean arm or flushing of the loading arm.
Number of solenoid retries	The number of retries for opening the solenoid again in case no additive pulses are received.
Pacing source	The physical source for the additive pacing. See section 15.2.1.4 for more information.
Permissive function	The permissive configuration for the controller. See section 15.2.1.6 for more information.
Permissive state	The permissive state of the controller. See section 15.2.1.3 for more information.
Product ID	The ID of the controller, e.g. SSC_A or MSC_A.
Product stream flow rate	The flow rate of the main product stream. The measuring unit is unit of volume per minute.
Pump run timeout	The time between the last injection and the additive pump stop. The measuring unit is seconds.
Pump start timeout	The amount of time after the pump demand output is driven that the pump indication input must be active. Otherwise, a No pump alarm is generated.
Slow flow volume alarm action	The alarm behavior in case the Slow flow volume alarm occurs. See section 15.2.1.2 for more information.
Software version	The software version of the board through which the data is read.
Solenoid close delay	Displays the time in which the additive pulses must be stopped after the solenoid is closed. The measuring unit is milliseconds.
Solenoid dwell time	Displays the minimum time the solenoid will open and close. The measuring unit is milliseconds. The parameter value is normally set to zero in injectors that require the solenoid to open and stay open until the full volume per cycle is injected. The numeric value represents the ‘ON’ time of the solenoid. The ‘OFF‘ time is equal to the ‘ON‘ time. When this value is nonzero, the controller will continue to pulse the valve control output until the amount of additive called for in the ‘Injection Volume’ setting is dispensed. The stroke repeat rate is double the solenoid dwell time.
Task register	Executes a task. See section 15.2.1.1 for more information.

Parameter Name	Description
Transaction closing time	The time to indicate the end of the transaction. The measuring unit is seconds. When within the end transaction time no wild stream pulses are received, the transaction will be finished.
Transaction PPM	The calculated additive PPM (parts per million) of the current transaction. This value is not updated synchronously with the transactional volumes.
Transactional additive stream gross observed volume	The transactional gross observed volume (GOV) of the additive stream. The measuring unit is unit of volume.
Transactional load stream gross observed volume	The transactional gross observed volume (GOV) of the load stream. The measuring unit is unit of volume.
Unit address	The ***primary*** address of the controller. The primary address is the value used to identify a particular controller to the master computer. This 3-digit number must be unique to each controller on a communication loop.
Volume per injection cycle	The amount of wild stream volume per injection cycle. The measuring unit is unit of volume.
Wild stream K-factor	The calibration K-factor of the flow meter that measures the wild stream. The measuring unit is pulses per unit of volume.

15.1.2 Controllers for Blending

TABLE 15-2 describes the parameters for controllers for blending (Fusion4 SSC-B).

TABLE 15-2 Description of Parameters for Blend Controllers

Parameter Name	Description
Accumulative blend stream gross observed volume	The accumulative gross observed volume (GOV) of the blend stream. The measuring unit is unit of volume.
Accumulative blend stream gross standard volume	The accumulative gross standard volume (GSV) of the blend stream. The measuring unit is unit of volume.
Accumulative blend volume (emulation mode only)	When the blender is operating in Mini-Pak emulation mode the blender responds to certain serial commands in the same manner as the SSC-A does. This emulation mode allows the SSC-B to be used by external preset loaders that only support external additive injectors. In order for the SSC-B to be externally controlled by via additive injector serial interface, it must return the accumulative blend volume for parameter 850 just as the SSC-A returns the accumulative additive volume for parameter 850. When operating in Mini-Pak emulation mode, this parameter will return the accumulative gross observed volume of blend product across all transactions.
Accumulative calibration gross observed volume	The accumulative gross observed volume of the product received in a calibrated vessel over all calibration operations. The measuring unit is unit of volume. To increase the accuracy of the flow meter, a calibration can be performed. This is done by comparing the actual resulting fuel volume received in a calibrated vessel with the displayed value on the screen of the controller, being the result of the value returned from the flow meter. With these two values a correction factor can be calculated, which then is used to (re-)calibrate the flow meter.
Accumulative leaking blend stream gross observed volume	The accumulative gross observed volume (GOV) of leaked blend product as a result of a leaking valve. The measuring unit is unit of volume.
Accumulative load stream gross observed volume	The accumulative gross observed volume (GOV) of the load stream. The measuring unit is unit of volume.
Accumulative wild stream gross observed volume	The accumulative gross observed volume (GOV) of the wild stream. The measuring unit is unit of volume.

Parameter Name	Description
Active alarms	Displays the active alarms. See section 15.2.2.18 for more information.
Blend high percentage allowed	The high percentage allowed before the ‘Blend percentage deviation’ alarm is generated. This is only evaluated at the end of the transaction with the total volumes.
Blend low percentage allowed	The low percentage allowed before the ‘Blend percentage deviation’ alarm is generated. This is only evaluated at the end of the transaction with the total volumes.
Blend percentage deviation alarm action	The alarm behavior in case the ‘Blend percentage deviation’ alarm occurs. See section 15.2.2.2 for more information.
Blend point relative to wild stream meter	The insertion point of the physical blend piping. See section 15.2.2.3 for more information.
Blend product expansion coeff	The expansion coefficient of the blend product.
Blend product observed density	The density of a ‘lab sample’ of blend product. The measuring unit is unit of density.
Blend Product observed pressure	The pressure of the ‘lab sample’ of blend product when its density was measured. The measuring unit is unit of pressure.
Blend Product observed temperature	The temperature of the ‘lab sample’ of blend product when its density was measured. The measuring unit is unit of temperature.
Blend stream closing time	The maximum time that is allowed for closing the blend valve. The measuring unit is seconds. If the controller still measures blend stream volume after this time, an alarm will be generated depending on the setting of the ‘Blend stream closing timeout alarm action’ parameter.
Blend stream closing timeout alarm action	The alarm behavior in case the ‘Blend stream closing timeout’ alarm occurs. See section 15.2.2.2 for more information.
Blend stream flow rate	The flow rate of the blend stream. The measuring unit is unit of volume per minute.
Blend stream K-factor	The calibration K-factor of the flow meter that measures the blend stream. The measuring unit is pulses per unit of volume.
Blend stream pressure	The pressure of the blend stream. The measuring unit is unit of pressure.

Parameter Name	Description
Blend stream pulse timeout	The time the controller keeps on being active after the blend stream pulses stop and the permissive is removed. The measuring unit is seconds. Once the permissive is removed, the controller will not report a control failure alarm. After the permissive is removed, the controller will close the digital control valve (DGV) immediately. The remaining blend stream volume during the pulse timeout period will be used to determine the final blend percentage.
Blend stream state	The state of the blend stream.See section 15.2.2.17 for more information.
Blend stream temperature	The temperature of the blend stream. The measuring unit is unit of temperature.
Broadcast address	The ***secondary*** communications address recognized by the Fusion4 SSC-B. It is not necessarily unique to any particular controller. This address is used by the master if it wants to transmit a command to more than one controller, simultaneously. The Fusion4 SSC-B will not respond to a message addressed to its broadcast address.
Calibration end flow volume	The amount of volume before the end of delivery of the calibration procedure when the controller will transition from the high flow rate to the low flow rate. The measuring unit is unit of volume. Note: This parameter is only applicable when doing a calibration of the blend stream flow meter.
Calibration end low flow volume	The amount of volume before the target calibration volume at which the blend flow rate should be reduced from full flow to the configured slow flow rate. Note: This parameter is only applicable when doing a calibration of the blend stream flow meter.
Calibration final shut down volume	The amount of volume before the end of delivery, when the controller will signal the digital control valve (DGV) to close. The measuring unit is unit of volume. Normally used when using slow valves to prevent ‘over’ flow at the end of the calibration process. Note: This parameter is only applicable when doing a calibration of the blend stream flow meter.
Calibration high flow rate	The maximum flow rate that is allowed through the blend stream. The measuring unit is unit of volume per minute. Note: This parameter is only applicable when doing a calibration of the blend stream flow meter.

Parameter Name	Description
Calibration inner control window limit	The volume at which the digital control valve (DCV) is pulsed open or closed. The measuring unit is unit of volume. If the flow rate is determined to be less than the value set by the Calibration inner control window limit, the control valve will remain locked at the current flow rate. If the flow rate is determined to be outside the value set by the Calibration inner control window limit, the controller will signal the DCV to either open or close, depending if the deviation volume is positive or negative. The maximum value for the Calibration inner control window limit must not be greater than the value for the Calibration outer control window limit. Note: This parameter is only applicable when doing a calibration of the blend stream flow meter.
Calibration low flow rate	The minimum flow rate that is allowed through the blend stream. The measuring unit is units of volume per minute. Note: This parameter is only applicable when doing a calibration of the blend stream flow meter.
Calibration low flow volume	The amount of volume at the start of a calibration run at during which the blend must remain at the slow flow rate before transitioning to the full flow rate. Note: This parameter is only applicable when doing a calibration of the blend stream flow meter.
Calibration outer flow rate control window	The volume at which the digital control valve (DCV) is continuously signaled to open or close. The measuring unit is unit of volume. If the flow rate is determined to be less than the value set by Calibration outer control window limit, the DCV will remain under control of the Calibration inner control window limit. If the flow rate is determined to be outside the value set by the Calibration outer control window limit, the controller will signal the DCV to either open or close by holding the proper solenoid continuously open or closed, depending if the deviation vol-ume is positive or negative. The maximum value for the Calibration outer control window limit must be greater than the value for the Calibration inner control window limit. Note: This parameter is only applicable when doing a calibration of the blend stream flow meter.

Parameter Name	Description
Calibration start low flow volume	The amount of volume that will be delivered at the low flow rate during the calibration procedure before the controller begins the transition to the high flow rate. The measuring unit is units of volume. Note: This parameter is only applicable when doing a calibration of the blend stream flow meter.
Clean start control	Defines how the controller knows when to stop blending while doing a clean arm operation. See section 15.2.2.8 for more information.
Commodity group	The commodity group of the blend product. See section 15.2.2.12 for more information.
Compressibility factor	A value calculated for type E commodities that describes how the volume is affected by pressure.
Control failure alarm action	The alarm behavior in case the ‘Control failure’ alarm occurs. See section 15.2.2.2 for more information.
Control failure alarm timeout	The time the controller will try to correct an out-of-tolerance blend, before generating the ‘Control failure’ alarm. The measuring unit is seconds.
Dead band control window limit	The allowed volume deviation from target blend volume. When the observed blend volume is less than dead band control window limit, the control output from the controller is locked. No correction is made to the blend stream control valve. This value effectively establishes the ‘dead band’ in which the blend stream volume can deviate without correction. The dead band is plus or minus this value.
Density (Base)	The calculated blend product base density based upon the lab sample data (density, temperature, and pressure). The measuring unit is unit of density.
Density (Lab)	The density of a ‘lab sample’ of blend product. The measuring unit is unit of density.
Density (Observed)	The currently calculated blend product density based upon the observed temperature, pressure, and base density. The measuring unit is unit of density.
Deviation count smoothing value	The number of successive samples that are averaged before calculating an actual deviation volume. This parameter eliminates incremental dips and spikes in the deviation volume calculation.
Device serial number	The serial number of the device.

Parameter Name	Description
DI hysteresis time	The active time of the input signal before accepting it as a valid input signal. So the time between two signal transitions must be greater than the DI Hysteresis time. The measuring unit is milliseconds.
Expansion factor	A factor that describes the rate of expansion for commodity type C products. It is expressed in units of (1/units of temperature) e.g., 1/°C or 1/°F.
Factored pulse output resolution 1	The physical source for the ‘Blend volume output 1’ function (factored pulses).See section 15.2.2.5 for more information.
Factored pulse output resolution 2	The physical source for the ‘Blend volume output 2’ function (factored pulses). See section 15.2.2.5 for more information.
Firmware version number	A six character string used to identify the firmware version number.
Flow calculation smoothing value	The number of successive samples that are averaged before calculating an actual deviation volume. This parameter eliminates incremental dips and spikes in the deviation volume calculation. Note: This parameter is only applicable when doing a calibration of the blend stream flow meter.
Flush volume	The amount of wild stream volume to realize the flushing by stopping the blending before the end of the transaction. The measuring unit is unit of volume. The flush volume is the amount of wild stream product that is to remain blend-product free in order to realize a clean arm when the flow stops. When the flush volume equals zero, the clean arm operation is disabled.
Flush volume alarm action	The the alarm behavior in case the Flush volume alarm occurs. See section 15.2.2.2 for more information.
Flush volume deviation	The maximum percentage of the flush volume that is allowed to be lower than the flush volume without resulting in an alarm situation (Slow flow alarm).
Glass hydrometer used	Indicates whether a glass hydrometer was used to meter the observed blend product density. If a glass hydrometer was used, the blend product observed density will be corrected for measurement error associated with glass hydrometers. See section 15.2.2.14 for more information.
Gross standard volume calculation interval	The amount of incremental gross observed volume over which the volume correction factor (CTPL) calculations are done (provided that the time since the last volume correction factor (CTPL) is between the minimum and maximum calculation interval values).

Parameter Name	Description
Inner control window limit	The allowed volume deviation from the target blend volume. The inner control window limit should be greater than the dead band window limit and less than middle control window limit. When the volume deviation is greater than the dead band window limit and less than the inner control window limit, the controller uses one-half the Solenoid active dwell configuration setting and double the Solenoid rest dwell configuration setting for controlling the blend stream control valve.
Instantaneous pressure	The current blend product pressure as measured from the 4-20 mA input (if used). The measuring unit is unit of pressure.
Instantaneous temperature	The instantaneous blend product temperature as measured from the temperature probe (if used). The measuring unit is unit of temperature.
Leaking blend valve alarm action	The alarm behavior in case the Leaking blend valve alarm occurs. See section 15.2.2.2 for more information.
Leaking blend valve volume limit	The maximum amount of leaking blend volume permitted. The measuring unit is unit of volume. If this limit is exceeded, an alarm will occur depending on the setting of the Leaking blend valve alarm action parameter.
Middle control window limit	The allowed volume deviation from the target blend volume. The middle control window limit should be greater than the inner control window limit and less than outer control window limit. When the volume deviation is greater than the inner control window limit and less than the outer control window limit, the controller uses the Solenoid active dwell and the Solenoid rest dwell configuration settings for controlling the blend stream control valve.
Minimum wild stream volume for alarm	The minimum amount of wild stream product that must be dispensed before the blend percentage alarm criteria are evaluated for alarm purposes. If the transactional blend percentage is outside the configured window after this time a blend percentage alarm will be generated.
Multifunction DC output #1	The physical source for the Blend volume output function (factored pulses). See section 15.2.2.5 for more information.
Multifunction DC output #2	Multifunction DC output #1.
No activity alarm action	The alarm behavior in case the No activity alarm occurs. See section 15.2.2.2 for more information

Parameter Name	Description
No activity timeout period	The time in which wild stream pulses should be received if the controller is permitted. When after this time no wild stream pulses have been received, an alarm will occur depending on the setting of the No Activity alarm action parameter. The measuring unit is seconds.
Outer control window limit	The allowed volume deviation from the target blend volume. The measuring unit is unit of volume. The outer control window limit should be greater than middle control window limit. When the volume deviation is greater than the Middle control window limit and less than the Outer control window limit, the controller uses double the Solenoid active dwell value and one-half the Solenoid rest dwell configuration settings for controlling the blend stream control valve.
Permissive function	The permissive configuration for the controller. See section 15.2.2.9 for Modbus RTU and section 15.2.2.10 for Modbus Legacy.
Permissive Hysteresis	The configured hysteresis time for DI AC 1 input channel (commonly used for permissive input). This parameter value always reflects the configured hysteresis time of this particular input channel and not the input channel configured for the permissive.
Permissive state	The permissive state of the controller. See section 15.2.2.4 for more information.
Pre-shutdown closure volume	The pre-shutdown volume used to correct the volume that is measured while closing the valve. The measuring unit is unit of volume.
Pre-shutdown volume	The mode of pre-shutdown control. Note: This parameter is only applicable if the Clean start control parameter is configured for Volume. See section 15.2.2.7 for more information.
Preset gross observed volume	The volume of product to be loaded during the transaction. The measuring unit is units of volume. The blend percentage is adjusted according to the amount defined in the Preset volume in order to increase the amount of blend stream product going into the load prior to flushing the arm at the end of the delivery. Note: This parameter is only applicable if the Flush volume is non-zero.

Parameter Name	Description
Pressure (base)	The pressure reference used to determine the base conditions of the volume correction of the GSV and mass. This base pressure must be set to a value accepted by the associated volume correction factor (CTPL) table configuration entity. The measuring unit is unit of pressure.
Pressure (lab)	The pressure of the ‘lab sample’ of blend product when its density was measured. The measuring unit is unit of pressure.
Pressure (observed)	The currently observed blend product pressure. The measuring unit is unit of pressure.
Pressure compensation used	Indicates whether pressure compensation was used to calculate the gross standard volume.
Product ID	The ID of the controller, e.g. ‘SSC_B’.
Product stream flow rate	The flow rate of the main product. The measuring unit is unit of volume per minute.
Recipe 1 target blend percentage	The ratio of the blend product compared to the combined total flow. The ratio is expressed as a percentage. This blend percentage is selected by a high or true signal on the Permissive 1 status input or via communications.
Recipe 2 target blend percentage	The ratio of the blend product compared to the combined total flow. The ratio is expressed as a percentage. This blend percentage is selected by a high or true signal on the Permissive 2 status input or via communications.
Recipe 3 target blend percentage	The ratio of the blend product compared to the combined total flow. The ratio is expressed as a percentage. This blend percentage is selected by a high or true signal on the Permissive 3 status input or via communications.
Recipe 4 target blend percentage	The ratio of the blend product compared to the combined total flow. The ratio is expressed as a percentage. This blend percentage is selected by a high or true signal on the Permissive 4 status input or via communications.
Recipe 5 target blend percentage	The ratio of the blend product compared to the combined total flow. The ratio is expressed as a percentage. This blend percentage is selected by a high or true signal on the Permissive 5 status input or via communications.
Reference pressure	The reference pressure used for volume correction. The measuring unit is unit of pressure.
Reference pressure units	The engineering unit for the reference pressure. See section 15.2.2.16 for more information.
Reference temperature	The reference temperature used for volume correction. The measuring unit is unit of temperature.

Parameter Name	Description
Reference temperature units	The engineering unit for the reference temperature. See section 15.2.2.15 for more information.
Reset blend deviation counter at transaction start	Defines if the deviation count is reset at the start of a new transaction. See section 15.2.2.6 for more information.
Software version	The software version of the board through which the data is read.
Solenoid active dwell	The time a solenoid is held in the state (energized or de-energized) that allows flow through it. The measuring unit is milliseconds. In case of a normally-closed (N.C.) solenoid, it is the energized open state.In case of a normally-open (N.O.) solenoid, it is the de-energized open state.
Solenoid rest dwell	The time a solenoid is held in the state (energized or de-energized) that stops flow through it. The measuring unit is milliseconds. In the case of a normally-closed (N.C.) solenoid, it is the de-energized closed state. In the case of a normally-open (N.O.) solenoid, it is the energized closed state.
Target blend percentage rate A	The ratio of the blend product compared to the combined total flow. The ratio is expressed as a percentage. This blend percentage is selected by a high or true signal on the Permissive A status input or via communications.
Target blend percentage rate B	The ratio of the blend product compared to the combined total flow. The ratio is expressed as a percentage. This blend percentage is selected by a high or true signal on the Permissive B status input or via communications.
Target blend percentage rate C	The ratio of the blend product compared to the combined total flow. The ratio is expressed as a percentage. This blend percentage is selected by a high or true signal on the Permissive C status input or via communications.
Target blend percentage rate D	The ratio of the blend product compared to the combined total flow. The ratio is expressed as a percentage. This blend percentage is selected by a high or true signal on the Permissive D status input or via communications.
Target blend percentage rate E	The ratio of the blend product compared to the combined total flow. The ratio is expressed as a percentage. This blend percentage is selected by a high or true signal on the Permissive E status input or via communications.
Task register	Executes a task. See section 15.2.2.1 for more information

Parameter Name	Description
Temperature (base)	The temperature reference used to determine the base conditions of the volume correction of the GSV and mass. This base temperature must be set to a value accepted by the associated volume correction factor (CTPL) table configuration entity. The measuring unit is unit of temperature.
Temperature (lab)	The temperature of the 'lab sample' of blend product when its density was measured. The measuring unit is unit of temperature.
Temperature (observed)	The currently observed blend product temperature. The measuring unit is unit of temperature.
Temperature compensation used	Indicates whether temperature compensation is used to calculate the gross standard volume (GOV).
Transaction deviation count	The difference between the actual measured transactional blend product volume and the expected blend product volume. The expected value is equal to the transactional load volume times the selected blend ratio. This deviation count is maintained after the transaction stops and is only cleared when a new transaction starts (or the device is reset).
Transactional blend percentage	The transactional blend stream percentage.
Transactional blend stream gross observed volume	The transactional gross observed volume (GOV) of the blend stream. The measuring unit is unit of volume.
Transactional blend stream gross standard volume	The transactional gross standard volume (GSV) of the blend stream. The measuring unit is unit of volume.
Transactional current average temperature	The transactional current average temperature of the blend stream. The measuring unit is unit of temperature.
Transactional load stream gross observed volume	The transactional gross observed volume (GOV) of the load stream. The measuring unit is unit of volume.
Transactional wild stream gross observed volume	The transactional gross observed volume (GOV) of the wild stream. The measuring unit is unit of volume.
Unit address	The ***primary*** communications address of the Fusion4 SSC-B. The primary address is the value used to identify a particular controller to the master computer. This 3-digit number must be unique to each controller on a communication loop.
VCF base to observed	The current volume correction factor (CTPL) used to convert the base blend product density to the calculated observed blend product density for the observed temperature and pressure.

Parameter Name	Description
VCF calculation interval max	The maximum amount of time between volume correction factor (CTPL) calculations on the incremental GOV. The measuring unit is seconds.
VCF calculation interval min	The minimum amount of time between volume correction factor (CTPL) calculations on the incremental GOV. The measuring unit is seconds.
VCF calculation interval volume	The amount of incremental GOV over which the volume correction factor (CTPL) calculations are done (as long at the time since the last volume correction factor (CTPL) is between the min and max calculation interval values). The measuring unit is unit of volume.
VCF lab to base	The current volume correction factor (CTPL) used to convert the measured lab sample density to a density of the same product as measured at base conditions.
VCF options	The options enabled when using the volume correction factor (CTPL) table. The extended temperature and pressure and range give the ability to do the volume conversion over a broader range than covered by the earlier versions of the standard. For instance at locations where it is very cold, like Alaska. See section 15.2.2.13 for more information. Note: When selected ‘None’ and the application goes beyond the normal range, an error will occur.
VCF status	The current status of the incremental volume conversion factor calculation. This value is 0 when no volume correction factor (CTPL) calculations are currently active and 1 when the controller is in the process of calculating a new volume correction factor (CTPL).
Volume (base)	The calculated standardized incremental volume for the last, incremental observed volume value. The measuring unit is unit of volume.
Volume correction table	The volume correction method use during the transaction. See section 15.2.2.11 for more information.
Wild stream closing volume	The maximum wild stream volume that is allowed after the permissive is removed. The measuring unit is unit of volume. If the controller detects an overrun of the maximum wild stream volume, an alarm will be generated depending on the setting of the ‘Wild stream closing volume alarm action’ parameter.
Wild stream closing volume alarm action	The alarm behavior in case the Wild stream closing volume alarm occurs. See section 15.2.2.2 for more information.

Parameter Name	Description
Wild stream flow rate	The flow rate of the wild stream. The measuring unit is unit of volume per minute.
Wild stream K- factor	The calibration K-factor of the flow meter that measures the wild stream. The measuring unit is pulses per unit of volume.
Wild stream pulse timeout	The time the controller will delay after the removal of the permissive and the absence of wild stream flow before determining the final transaction totals. The measuring unit is seconds.

15.1.3 Controllers for Loading

=> Future implementation

15.2 Appendix B: Values in Enumeration-Type Tables

15.2.1 Controllers for Additive Injection

15.2.1.1 Task Register

TABLE 15-3 lists the possible values of the [Task register] parameter for additive controllers.

TABLE 15-3 Possible values of [Task register] parameter

Value	Legacy Parameter	Description
0x0001	001	Disable permissive
0x0002	010	Enable permissive
0x0004	050	Inject now
0x0008	070	Open solenoid
0x0010	071	Close solenoid
0x0020	301	Clear all alarms
0x0040	800	Clear all totals, see also TABLE 15-4
0x0080	801	Clear wild stream totals only, see TABLE 15-4
0x0100	802	Clear additive stream totals only, see TABLE 15-4
0x0200	940	Reset device
0x0400	030	Slow flow enable
0x0800	031	Slow flow disable

TABLE 15-4 Description of Clear Stream Commands

Value	Legacy Parameter	Description	810	850		870	880
0x0040	800	Clear all totals	4	4	4	4	4
0x0080	801	Clear wild stream totals only	4				
0x0100	802	Clear additive stream totals only		4	4	4	4

15.2.1.2 Alarm Action

TABLE 15-5 lists the possible values of the [Alarm action] parameter for additive controllers.

TABLE 15-5 Possible values of [Alarm action] parameter

Value	Definition	Description
0	Disabled	If the parameter is set to [0], the alarm-indication output is set to OFF.
1	Display	If the parameter is set to [1], the following actions take place: • The alarm-indication output is set to ON. • The alarm is shown on the display.
2	Shutdown	If the parameter value is set to [2], then the following actions take place: • The alarm-indication output is set to ON. • The alarm is shown on the display. • The alarm-shutdown output is set to ON. • The running transactions are stopped. • The start-up of new transactions impossible.

15.2.1.3 Permissive State

TABLE 15-6 lists the possible values of the [Permissive state] parameter for additive controllers.

TABLE 15-6 Possible values of [Permissive state] parameter

Value	Definition	Description
0	Not permitted	If the parameter value is set to [0], the controller is not permitted to start a (new) injection transaction.
1	Permitted	If the parameter value is set to [1], the controller is permitted to start a (new) injection transaction.

15.2.1.4 Pacing Source

TABLE 15-7 lists the possible values of the [Pacing source] parameter for additive controllers.

TABLE 15-7 Possible values of [Pacing source] parameter

Value	Definition	Description
0	Smart	If the parameter value is set to [0] the solenoid is controlled by an external device. The Smart mode offers four different options, which can be chosen by the [Pacing source] I/O binding entity. • **PI (Pulse Input) Mode** In this mode, the controllers measures the wild stream itself. The [Volume per injection cycle] parameter determines when an injection is started. The amount of additive volume is determined by setting the [Additive injection volume] parameter. The K-factor of the pacing pulse is determined by setting the [K-factor] parameter. • **Comms Mode** On receipt of a trigger message from an RS-485 source (Comms), the controller injects the proper amount of additive into the wild stream. The amount of additive can be configured by the [Additive injection volume] parameter. • **DI (Digital Input) Mode** On receipt of a trigger signal from an Digital Input (DI)source, the controller injects the proper amount of additive into the wild stream. The amount of additive can be configured by the [Additive injection volume] parameter. • **AI (Analog Input) Mode** In this mode the controller receives wild stream flow from an Analog Input (AI) source. The [Volume per injection cycle] parameter determines when an injection is started. The amount of additive volume is determined by setting the [Additive injection volume] parameter. The K-factor of the pacing pulse is determined by setting the [K-factor] parameter.

Value	Definition	Description
1	Slave	If the parameter value is set to [1], the solenoid is controlled by an external device. The controller receives a command to open the solenoid. The solenoid then remains open until the controller receives a command to close it again.
2	Self	In situations where no pacing signals are available from outside sources like flow meters or other instruments, the [Pacing source] parameter of the controller can be set to [2]. In this mode, the controller injects on a time and fluid volume basis.

15.2.1.5 Factored Pulse Output

TABLE 15-8 lists the possible values of the [Factored pulse output] parameter for additive controllers.

REMARK: The values in brackets are used in legacy protocols.

TABLE 15-8 Possible values of [Factored pulse output] parameter

Value	Definition
2 (0)	1 pulse per unit volume
3 (1)	10 pulses per unit volume
4 (2)	100 pulses per unit volume
5 (3)	1000 pulses per unit volume

15.2.1.6 Permissive Function

TABLE 15-9 lists the possible values of the [Permissive function] parameter for additive controllers.

TABLE 15-9 Possible values of [Permissive function] parameter

Value	Definition	Description
0	None	If the parameter value is set to [0], then the permissive is internally asserted based upon the injector mode. **Smart product pulse** • Transaction start condition: When the wild stream volume is greater than the [Minimum product volume for transaction] parameter. • Transaction end condition: When the wild stream flow rate has been less than the low flow rate for an amount of time defined by the [Transaction closing time] parameter. **Smart inject (DI or Comms)** • Transaction start condition: When the first inject signal is received. • Transaction end condition: When there has been no inject signals for an amount of time defined by the [Transaction closing time] parameter. **Slave (DI or Comms)** • Transaction start condition: When the first solenoid-open condition is detected. • Transaction end condition: When there has been no solenoid-open condition detected for an amount of time defined by the [Transaction closing time] parameter.
1	Hard-wired	If the parameter value is set to [1], then the following conditions are valid regardless of the injection mode • Transaction start condition - When the digital input is asserted • Transaction end condition - When the digital input is unasserted

Value	Definition	Description
2	Communications	If the parameter value is set to [2], then the following conditions are valid regardless of the injection mode: • Transaction start condition - When a serial command is received to enable the device • Transaction end condition -When a serial command is received to disable the device

15.2.1.7 Additive Stream State

TABLE 15-10 lists the possible values of the [Additive stream state] parameter for additive controllers.

TABLE 15-10 Possible values of [Additive stream state] parameter

Value	Definition
0	Stop
1	Startup
2	Interrupted
3	Failed
4	Permitted
5	Running
6	Paused
7	Testing
8	Starting

15.2.1.8 Active Alarms (individual bits in 16-bits data)

TABLE 15-11 lists the possible values of the [Active alarms] parameter for additive controllers.

TABLE 15-11 Possible values of [Active alarms] parameter

Value	Definition
0x0001	Additive Cycle Volume
0x0002	No Additive
0x0004	Leaking Solenoid
0x0008	Firmware Failure
0x0010	Program Failure

Value	Definition
0x0020	No Activity
0x0040	Flush Volume Error
0x0080	Valve Error
0x0100	No Pump
0x0200	License Error
0x0400	Control Failure
0x0800	Power Failure
0x1000	Pulse Error
0x2000	Tank Monitor Error
0x4000	Service Due Rem
0x8000	Reserved

15.2.2 Controllers for Blending

15.2.2.1 Task Register

TABLE 15-12 lists the possible values of the [Task register] parameter for blend controllers.

TABLE 15-12 Possible values of [Task register] parameter

Value	Legacy Parameter	Description
0x0001	001	Disable permissive
0x0002	010	Enable blend Rate A
0x0004	011	Enable blend Rate B
0x0008	012	Enable blend Rate C
0x0400	013	Enable blend Rate D
0x0800	014	Enable blend Rate E
0x0010	301	Clear all alarms
0x0020	800	Clear all totals, see also TABLE 15-13
0x0040	801	Clear wild stream totals only, see also TABLE 15-13
0x0080	802	Clear blend stream totals only, see also TABLE 15-13
0x0200	940	Reset device

TABLE 15-13 Description of Clear Stream Commands

Value	Legacy Parameter	Description	810	820	825	870	880
0x0020	800	Clear all totals	4	4	4	4	4
0x0040	801	Clear wild stream totals only	4				
0x0080	802	Clear blend stream totals only		4	4	4	4

15.2.2.2 Alarm Action

TABLE 15-14 lists the possible values of the [Alarm action] parameter for blend controllers.

TABLE 15-14 Possible values of [Alarm action] parameter

Value	Definition	Description
0	Disabled	If the parameter value is set to [0], the alarm is ignored
1	Display	If the parameter value is set to [1], the following actions take place: • The alarm-indication output is set to ON. • The alarm is shown on the display.
2	Shutdown	If the parameter value is set to [2], the following actions take place: • The alarm-indication output is set to ON. • The alarm is shown on the display. • The alarm-shutdown output is set to ON. • The running transactions are stopped. • The start-up of new transactions impossible.

15.2.2.3 Blend Point Relative to Wild Stream

TABLE 15-15 lists the possible values of the [Blend point relative to wild stream] parameter for blend controllers.

TABLE 15-15 Possible values of [Blend point relative to wild stream] parameter

Value	Definition	Description
0	Upstream	If the parameter value is set to [0], the insertion point of the physical blend piping will be before the wild stream custody transfer meter.
1	Downstream	If the parameter value is set to [1], the insertion point of the physical blend piping will be after the wild stream custody transfer meter.

15.2.2.4 Permissive State

TABLE 15-16 lists the possible values of the [Permissive state] parameter for blend controllers.

TABLE 15-16 Possible values of [Permissive state] parameter

Value	Definition	Description
0	Not permitted	If the parameter value is set to [0], the controller is not permitted to start a (new) injection transaction.
1	Permitted	If the parameter value is set to [1], the controller is permitted to start a (new) injection transaction.

15.2.2.5 Factored Pulse Output

TABLE 15-17 lists the possible values of the [Factored pulse output] parameter for blend controllers.

REMARK: The values in brackets are used in Legacy protocols.

TABLE 15-17 Possible values for [Factored pulse output] parameter

Value	Definition
2 (0)	1 pulse per unit volume
3 (1)	10 pulses per unit volume
4 (2)	100 pulses per unit volume
5 (3)	1000 pulses per unit volume

15.2.2.6 Reset Blend Deviation Counter at Transaction Start

TABLE 15-18 lists the possible values of the [Reset blend deviation counter at transaction start] parameter for blend controllers.

TABLE 15-18 Possible values for [Reset blend deviation counter at transaction start] parameter

Value	Definition	Description
0	No reset	If the parameter value is set to [0], the deviation volume count is never reset to zero at the start of a new transaction.
1	Reset deviation	If the parameter value is set to [1], the deviation volume count is reset to zero at the start of each new transaction.

15.2.2.7 Pre-Shutdown Control

TABLE 15-19 lists the possible values of the [Pre-shutdown control] parameter for blend controllers.

TABLE 15-19 Possible values of [Pre-shutdown control] parameter

Value	Definition	Description
0	No pre-shutdown	If the parameter value is set to [0], the controller enters the clean arm operation when the measured volume is equal to the preset volume minus the flush volume.
1	Fixed pre-shutdown	If the parameter value is set to [1], the controllers enters the clean arm operation when the measured volume is equal to the preset volume minus the flush volume and the pre-shutdown volume.

Value	Definition	Description
2	Calculated pre-shut-down	If the parameter value is set to [2], the controller enters the clean arm operation when the measured volume is equal to the preset volume minus the flush volume and the pre-shutdown volume. At the end of every transaction the preshutdown volume is calculated to get a more precise number on when to stop blending. It can be seen as a correction factor for the valve closing time.

15.2.2.8 Clean Start Control

TABLE 15-20 lists the possible values of the [Clean start control] parameter for blend controllers.

TABLE 15-20 Possible values of [Clean start control] parameter

Value	Definition	Description
0	Permissive controlled	If the parameter value is set to [0], the controller stops blending when the permissive is removed. The controller expects the flush volume to flow to bring the blend percentage down to the target blend percentage.
1	Volume controlled	If the parameter value is set to [1], the controller is monitoring the delivered volume to determine when to stop blending, regardless of the permissive signal. To enable this functionality the controller needs to know the preset volume.

15.2.2.9 Permissive Function (Modbus RTU | TCP/IP)

TABLE 15-21 lists the possible values of the Modbus RTU | TCP/IP [Permissive function] parameter for blend controllers.

TABLE 15-21 Possible values of Modbus RTU | TCP/IP [Permissive function] parameter

Value	Definition	Description
0	Logic OR	If the parameter value is set to [0], the controller is enabled when either (or both) the primary or (and) secondary permissives are true.
1	Logic AND	If the parameter value is set to [1], the controller is enabled when both the primary and secondary permissives are true.

15.2.2.10 Permissive Function (Modbus Legacy)

TABLE 15-22 lists the possible values of the Modbus Legacy [Permissive function] parameter for blend controllers.

TABLE 15-22 Possible values of Modbus Legacy [Permissive function] parameter

Value	Definition	Description
0	Permitted only via hard-ware	Parameter value set to [0] indicates if a blend stream has both a permissive and a secondary interlock defined then either one or both must be active in order for the stream to be permitted. The SSC_B I/O binding possibilities for both the permissive function and the secondary interlock function include options for both hard wired digital inputs as well as "Comms" inputs. If a hardwired digital input binding is selected then the input must be active and if "Comms." is selected then the device must be permitted either by a serial comms. message or locally by a hand-held controller.
1	Permitted via hardware and software	Parameter value set to [1] indicates if a blend stream has both a permissive and a secondary interlock defined then both must be active in order for the stream to be permitted. The SSC_B I/O binding possibilities for both the permissive function and the secondary interlock function include options for both hard wired digital inputs as well as "Comms" inputs. If a hardwired digital input bind-ing is selected then the input must be active and if "Comms." is selected then the device must be permitted either by a serial comms. message or locally by a hand-held controller.

15.2.2.11 Volume Correction Table

TABLE 15-23 lists the possible values of the [Volume correction table] parameter for blend controllers.

TABLE 15-23 Possible values of [Volume correction table] parameter

Value	Definition
0	NO VCF TABLE
1	ASTM D1250_04 5/6

Value	Definition
2	ASTM D1250_04 23/24
3	ASTM D1250_04 53/54
4	ASTM D1250_04 59/60
5	ASTM GPA TP27 2007 23/24
6	ASTM GPA TP27 2007 53/54
7	ASTM GPA TP27 2007 59/60
8	EN 14214 2008

15.2.2.12 Commodity Group

TABLE 15-24 lists the possible values of the [Commodity group] parameter for blend controllers.

TABLE 15-24 Possible values of [Commodity group] parameter

Value	Definition
0	None
1	Crude Oil
2	Commodity Group Refined Products
3	Special Applications
4	Lubricating Oils
5	NGL And LPG
6	Fatty Acid Methyl Esters

15.2.2.13 VCF Options

TABLE 15-25 lists the possible values of the [VCF options] parameter for blend controllers.

TABLE 15-25 Possible values of [VCF options] parameter

Value	Definition	Description
0	None	If the parameter value is set to [0], the Volume Conversion Tables do not accept observed temperatures within the extended temperature range.

Value	Definition	Description
1	Extended ranges	If the parameter value is set to [1], the Volume Conversion Tables accept observed temperatures within the extended temperature range. • For ASTM tables this range is -94°F to 338°F. • For GPA-TP27 tables this range is 213.25K to 369.82K. • FAME conversions do not support any extended temperature range. Therefore, it will continue to only support the range limits of 20°C to 60°C even if configured for extended range. Observed temperatures exceeding this range will generate an error.

15.2.2.14 Glass Hydrometer Used

TABLE 15-26 lists the possible values of the [Glass hydrometer used] parameter for blend controllers.

TABLE 15-26 Possible values of [Glass hydrometer used] parameter

Value	Definition	Description
0	Glass hydrometer used for density	If the parameter value is set to [0], the glass hydrometer is used to measure the observed blend product density. In this case, the observed blend product observed will be corrected for measurement error associated with glass hydrometers.
1	Glass hydrometer not used for density	If the parameter value is set to [1], the glass hydrometer is not used to measure the observed blend product density.

15.2.2.15 Reference Temperature Units

TABLE 15-27 lists the possible values of the [Reference temperature units] parameter for blend controllers.

TABLE 15-27 Possible values of [Reference temperature units] parameter

Value	Definition	Description
1	Celsius	If the parameter value is set to [1], degrees Celsius (°C) is used as unit of temperature for the [Reference temperature] parameter.
2	Fahrenheit	If the parameter value is set to [2], degrees Fahrenheit (°F) is used as unit of temperature for the [Reference temperature] parameter.

15.2.2.16 Reference Pressure Units

TABLE 15-28 lists the possible values of the [Reference pressure units] parameter for blend controllers.

TABLE 15-28 Possible values of [Reference pressure units] parameter

Value	Definition	Description
1	Pascal	If the parameter value is set to [1], Pascal (Pa) is used as unit of pressure for the [Reference pressure] parameter.
2	kilo Pascal	If the parameter value is set to [2], kilo Pascal (kPa) is used as unit of pressure for the [Reference pressure] parameter.
3	pounds per square inch (small)	If the parameter value is set to [3], pounds per square inch (Psi) small is used as unit of pressure for the [Reference pressure] parameter.
4	pounds per square inch (large)	If the parameter value is set to [4], pounds per square inch (Psi) large is used as unit of pressure for the [Reference pressure] parameter.
5	bar	If the parameter value is set to [5], bar is used as unit of pressure for the [Reference pressure] parameter.

15.2.2.17 Blend Stream State

TABLE 15-29 lists the possible values of the [Blend stream state] parameter for blend controllers.

TABLE 15-29 Possible values of [Blend stream state] parameter

Value	Definition
0	Idle
1	Startup
2	Interrupted
3	Failed
4	Permitted
5	Running
6	Paused
7	Testing
8	Starting

15.2.2.18 Active Alarms (individual bits in 16-bits data)

TABLE 15-30 lists the possible values of the [Active alarms] parameter for blend controllers.

TABLE 15-30 Possible values of [Active alarms] parameter

Value	Definition
0x0001	Control Failure
0x0002	Blend Percentage
0x0004	Leaking Blend Valve
0x0008	Wild Stream Closing Volume
0x0010	Blend Stream Closing Time
0x0020	No Activity
0x0040	Firmware Corrupt
0x0080	VCF Error
0x0100	Flush Volume
0x0200	License Error
0x0400	Valve Error
0x0800	Power Failure

Value	Definition
0x1000	Pulse Error
0x2000	No Pump
0x4000	Sensor Error
0x8000	Tank Monitor Error

15.2.3 Controllers for Loading

=> Future implementation

For More Information

To learn more about Honeywell Enraf's solutions, contact your Honeywell Enraf account manager or visit www.honeywellenraf.com.

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