Instructions - Parts

Communications Gateway Module Installation Kit

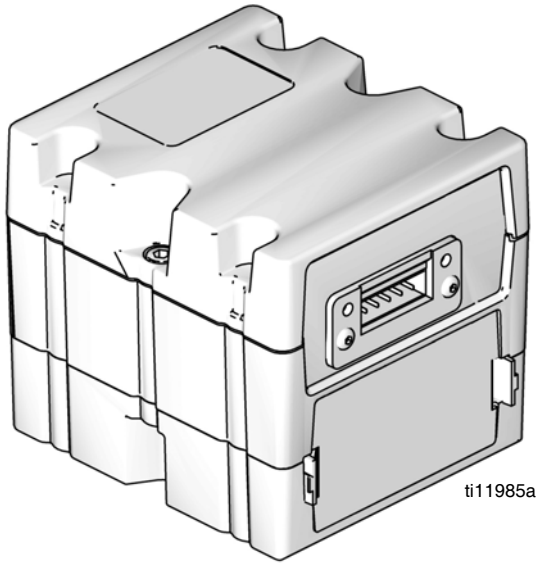
3A6338C

EN

For use with Electric Fixed Ratio (EFR) systems to provide fieldbus communications abilities. For professional use only.

Important Safety Instructions

Read all warnings and instructions in this manual and in your system manual before using the equipment. Save these instructions.



CGM with DeviceNet connector shown

Contents

Related Manuals

Manual	Description
312864	Communications Gateway Module, Instructions - Parts
3A6165	Electric Fixed Ratio Proportioner, Setup - Operation
406987	GCA CAN Cables, Reference

Models

Part	Description
25B127	DeviceNet CGM Kit
26A700	EtherNet/IP CGM Kit
26A701	PROFIBUS CGM Kit
26A702	PROFINET CGM Kit

Overview

The Communications Gateway Module (CGM) provides a control link between the Electric Fixed Ratio (EFR) system and a selected fieldbus. This provides the means for report monitoring and control by external automation systems.

NOTE: The following system network configuration files are available at help.graco.com.

- EDS file: DeviceNet or Ethernet/IP fieldbus networks
- GSD file: PROFIBUS fieldbus networks
- GSDML: PROFINET fieldbus networks
- ACD file: DeviceNet or Ethernet/IP fieldbus networks

The following components are included in the CGM Installation Kit.

Ref.	Description	Qty.
A	CGM Kit	1
AA	Gateway Module	1
AB	Mounting Bracket	1
B	Screw, #10-32 x .50	2
C	Washer, #10, Nylon	2
D	Communication Cable (not shown)	1

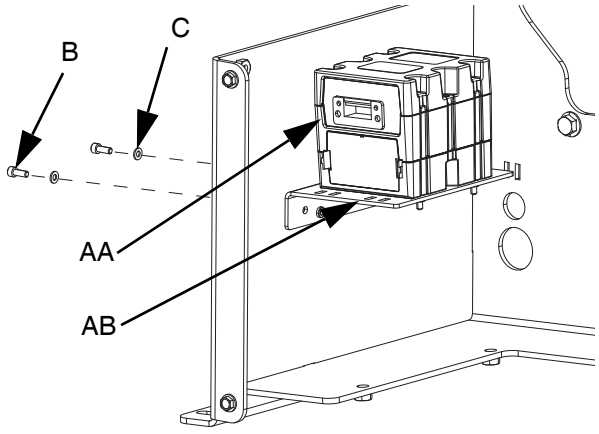


FIG. 1

CGM Software

The following software is must be installed on the CGM module to work properly with the EFR CGM map 19A796.

- 17P796, version 3.01.004

Installation

⚠ WARNING

ELECTRIC SHOCK HAZARD

To avoid electric shock, make sure the system power is OFF before connecting or disconnecting CAN cables.

PRESSURIZED FLUID HAZARD

This equipment stays pressurized until pressure is manually relieved. To help prevent serious injury from pressurized fluid, such as skin injection, splashing fluid and moving parts, follow Pressure Relief Procedure when you stop spraying and before cleaning, checking or servicing the equipment.

PERSONAL PROTECTIVE EQUIPMENT

Wear appropriate protective equipment when in the work area to help prevent serious injury, including eye injury, hearing loss, inhalation of toxic fumes, and burns.

1. Ensure the system power is OFF and pressure has been relieved. Follow the Pressure Relief Procedure in the Electric Fixed Ratio Proportioner, Setup - Operation manual.

2. Remove the pump yoke shroud (F) and frame cover (G) from the EFR system.

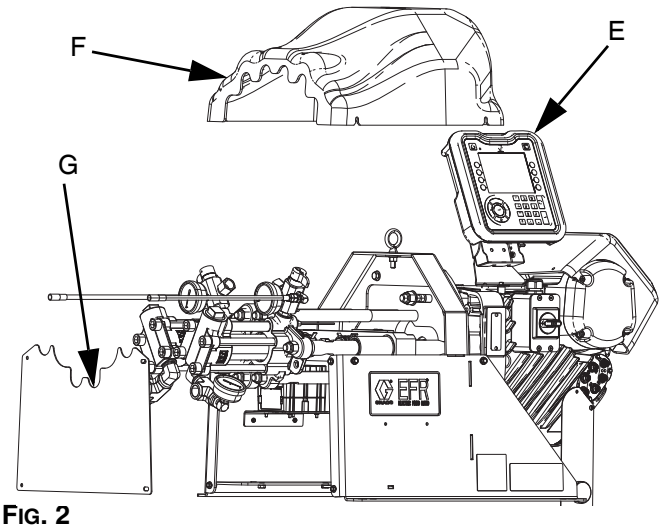


FIG. 2

3. Mount the CGM Kit (A) inside the system frame with two screws (B) and washers (C).

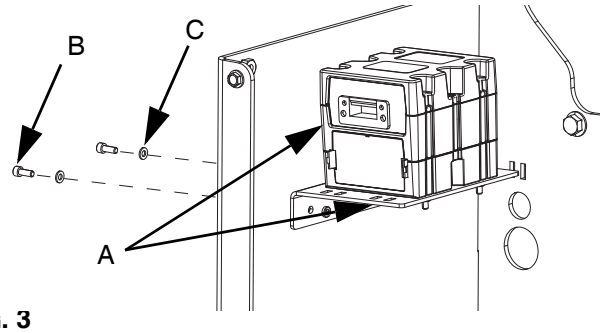


FIG. 3

4. Secure cables (CAN, J) to the frame using the cable ties (H) provided, and route them through the protected opening as shown in FIG. 4.

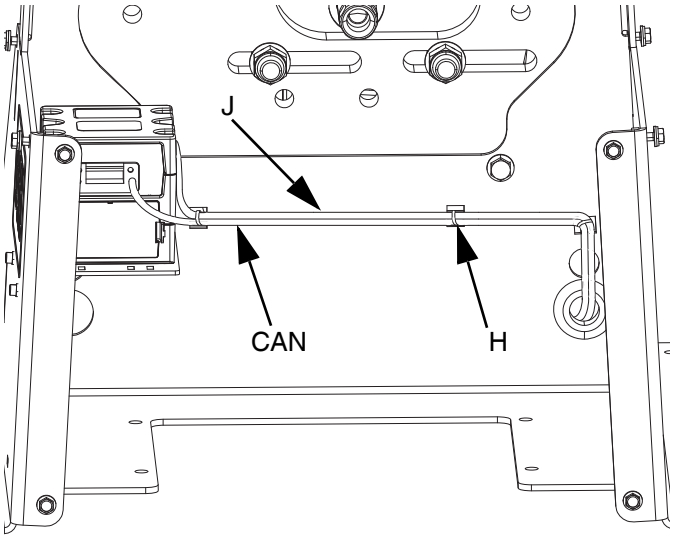


FIG. 4

5. Connect the CAN cable from either CAN connection on the CGM to port 2 on the EFR.

NOTICE

Ensure the CAN cable is connected to the appropriate CAN connection. Failure to connect the CAN cable to the correct CAN connection can result in damage to the CGM module.

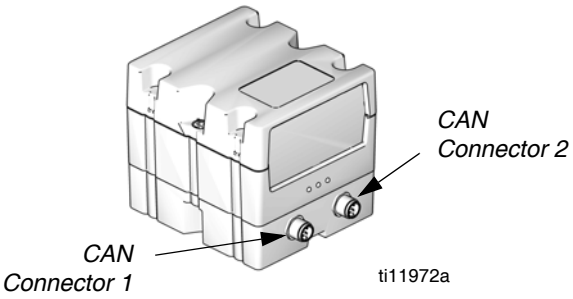


FIG. 5: Cable Connections

6. If used, connect the Ethernet, DeviceNet, or PROFIBUS cable (J) to the CGM as applicable. Connect the other end of the cable to the FieldBus device.

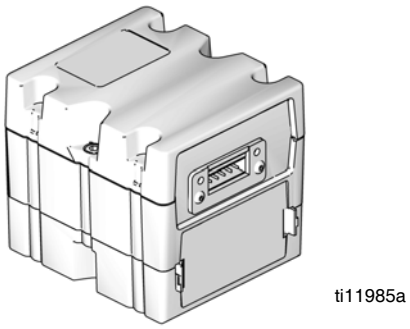


FIG. 6: Cable Connections

7. Reinstall the pump yoke shroud (F) and the frame cover (G) onto the EFR system.

8. Perform the Install or Update Data Map procedure in the Communications Gateway Module, Instructions – Parts manual.

9. See **Available Internal Data** on page 8 for details regarding the FieldBus pinout setup.

10. Perform the **Setup** procedure on page 5 to configure the fieldbus.

NOTE: To produce an accurate dispense, the dispense valve must be controlled directly by the EFR. See the Electric Fixed Ratio Proportioner, Setup - Operation manual for I/O integration of the dispense valve with the EFR.

NOTE: See **Automation Outputs (signals from PLC to EFR System)** on page 22 for information on triggering a dispense through the EFR using the CGM.

Setup

EFR and PLC Connection

Verify the PLC connection parameters are setup correctly.

NOTE: The connection between the EFR and PLC will not be made if the PLC connection parameters are not set up correctly.

Standard Gateway Map: 19A796	
Comm. Format	**Data-SINT**
Input Assembly Instance	100
Input Byte Size	42
Output Assembly Instance	150
Output Byte Size	22

Gateway Screens

The Gateway screens are used to configure the fieldbus. These screens are shown only if a CGM is correctly installed in your system. See **Installation** on page 3.

1. With the system on and enabled, press  to access the Setup screens.
2. Press the left arrow key once to navigate to the main Gateway screen. See FIG. 7.

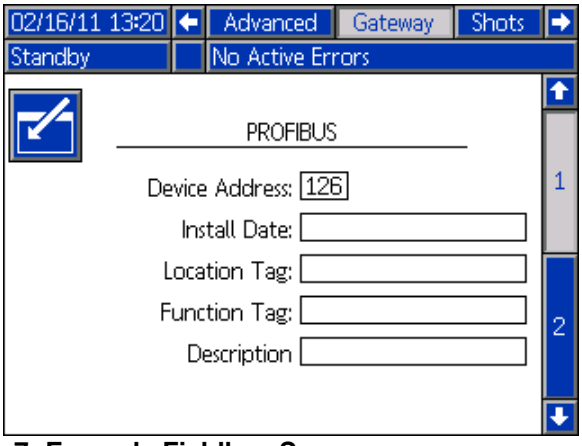


FIG. 7: Example Fieldbus Screen

PROFIBUS Fieldbus Screens

These screens are shown only if a PROFIBUS Fieldbus CGM is installed.

Screen 1

This screen enables the user to set the device address, install date, location tag, function tag, and description.

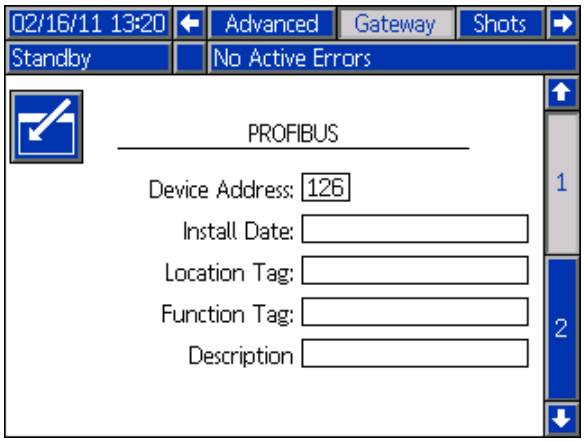


FIG. 8: PROFIBUS Fieldbus Screen 1

Screen 2

This screen displays the hardware revision, system serial number, and data map identification information.

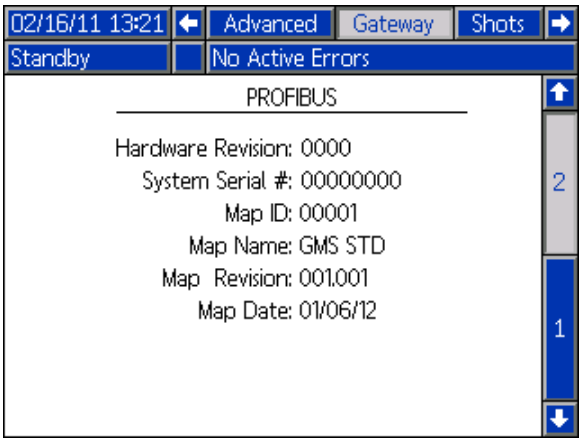


FIG. 9: PROFIBUS Fieldbus Screen 2

PROFINET Fieldbus Screens

These screens are shown only if a PROFINET Fieldbus CGM is installed.

Screen 1

This screen enables the user to set the IP Address, DHCP settings, subnet mask, gateway, and DNS information.

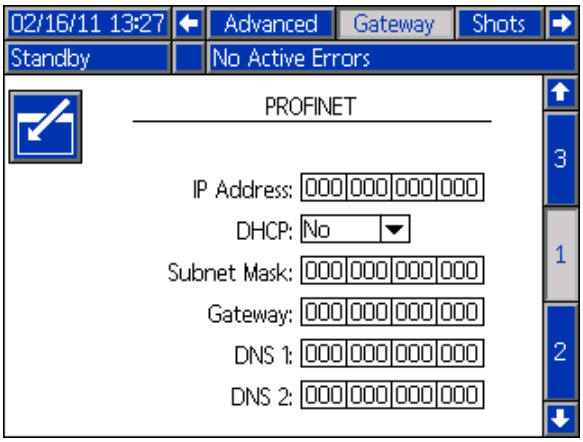


FIG. 10: PROFINET Fieldbus Screen 1

Screen 2

This screen enables the user to set the station name, install date, location tag, function tag, and description.

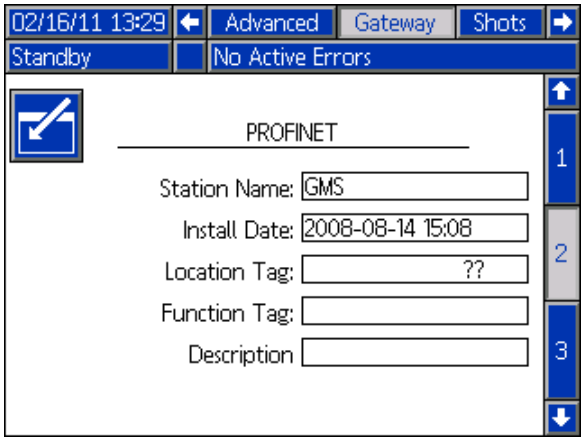


FIG. 11: PROFINET Fieldbus Screen 2

Screen 3

This screen displays the hardware revision, system serial number, and data map identification information.

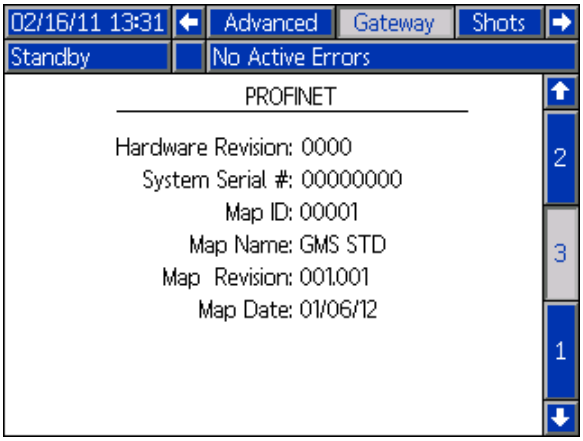


FIG. 12: PROFINET Fieldbus Screen 3

EtherNet/IP Fieldbus Screens

These screens are shown only if an EtherNet/IP Fieldbus CGM is installed.

Screen 1

This screen enables the user to set the IP address, DHCP settings, subnet mask, gateway, and DNS information.

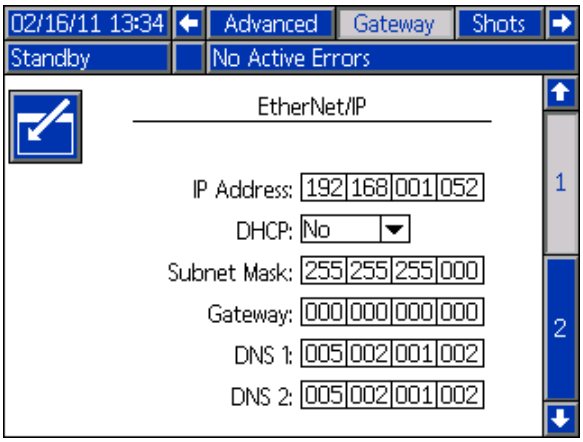


FIG. 13: EitherNet/IP Fieldbus Screen 1

Screen 2

This screen displays the hardware revision, system serial number, and data map identification information.

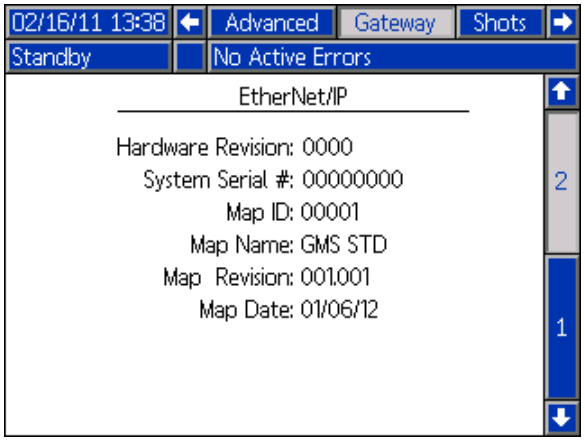


FIG. 14: EtherNet/IP Fieldbus Screen 2

DeviceNet Fieldbus Screen

This screen is shown only if a DeviceNet Fieldbus CGM is installed.

This screen enables the user to set the device address and baud rate, as well as view the hardware revision, system serial number, and data map identification information.

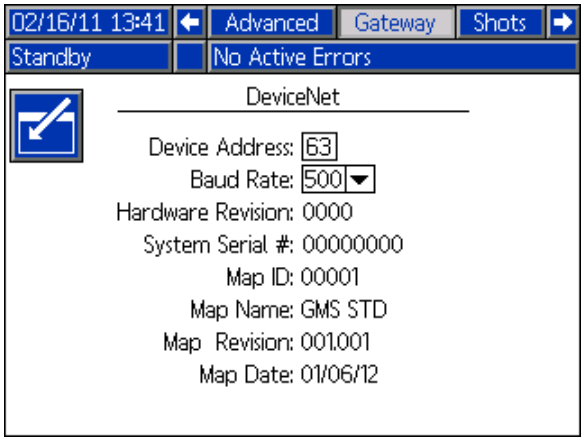


FIG. 15: DeviceNet Fieldbus Screen

Available Internal Data

See **Appendix A - I/O Signal Descriptions** on page 19 for additional details regarding each input/output. Unless stated otherwise:

- In each instance, bytes are stored in little endian order (most significant to least significant).
- PROFIBUS and PROFINET data must be mirrored by the PLC to get the correct data out on the PLC side. When the data is mirrored, the least significant byte is inserted into the most significant spot, and the most significant byte is inserted into the least significant spot.
    - *Example*: If the data is a binary number with 0011100110110111, mirroring it to get the correct data out of the PROFIBUS or PROFINET will result in 0111101110010011.
- Values are subject to the same maximum and minimum restrictions as the ADM.

NOTE: Automation Outputs can be monitored by the corresponding Automation Inputs to verify the EFR received the data correctly.

Automation Inputs (signals from EFR system to PLC)

Instance ID	Description	Data Type	BIT	Input Byte Index's
1	Heartbeat To PLC	Boolean	0	0
2	System On	Boolean	1	
3	System Ready	Boolean	2	
4	Active Alarms	Boolean	3	
5	Active Deviations	Boolean	4	
6	Active Advisories	Boolean	5	
7	Current Sequence is Playing	Boolean	6	
8	Current Sequence is Paused	Boolean	7	
9	Current Sequence is Stopped	Boolean	8	1
10	Dispense Valve Open	Boolean	9	
11	System is Priming	Boolean	10	
12	System is Purging	Boolean	11	
13	System is Parking	Boolean	12	
14	System is Depressurizing	Boolean	13	
15	Gel Shot is Running	Boolean	14	
16	EFR is Dispensing	Boolean	15	
17	{Reserved Bits}	Boolean	16-23	2
18	{Reserved Bits}	Boolean	24-31	3
19	Current Active Sequence	uint8	0-7	4
20	Current Step of the Active Sequence	uint8	0-7	5
21	Time Remaining to Complete Step (XX.X s)	uint16	0-7	6
			8-15	7
22	Red Pump Outlet Pressure (XXXX.X bar)	uint16	0-7	8
			8-15	9
23	Blue Pump Outlet Pressure (XXXX.X bar)	uint16	0-7	10
			8-15	11
24	Red Pump Inlet Pressure (XXXX.X bar)	uint16	0-7	12
			8-15	13
25	Blue Pump Inlet Pressure (XXXX.X bar)	uint16	0-7	14
			8-15	15
26	Pump Flow Rate (XXXX cc/min)	uint16	0-7	16
			8-15	17
27	Active Error Number Requiring Acknowledgment	uint8	0-7	18
28	Active Operator Mode Dispense Flow Rate (XXXX cc/min)	uint16	0-7	19
			8-15	20
29	Data Exchanged Element Selected	uint8	0-7	21
30	Data Exchanged Element Value	uint16	0-7	22
			8-15	23
31	Selected Step of the Active Sequence	uint8	0-7	24
32	Selected Step Amount (XXXX.XX)	uint32	0-7	25
			8-15	26
			16-23	27
			24-31	28

Instance ID	Description	Data Type	BIT	Input Byte Index's
33	Selected Step Shot Type	uint8	0-7	29
34	Selected Step Flow Rate (XXXX cc/min)	uint16	0-7	30
			8-15	31
35	Selected Step Calibration (XX.XX)	uint16	0-7	32
			8-15	33
36	Total Sequence Amount Requested (XXXX.XX cc)	uint32	0-7	34
			8-15	35
			16-23	36
			24-31	37
37	Total Sequence Amount Dispensed (XXXX.XX cc)	uint32	0-7	38
			8-15	39
			16-23	40
			24-31	41

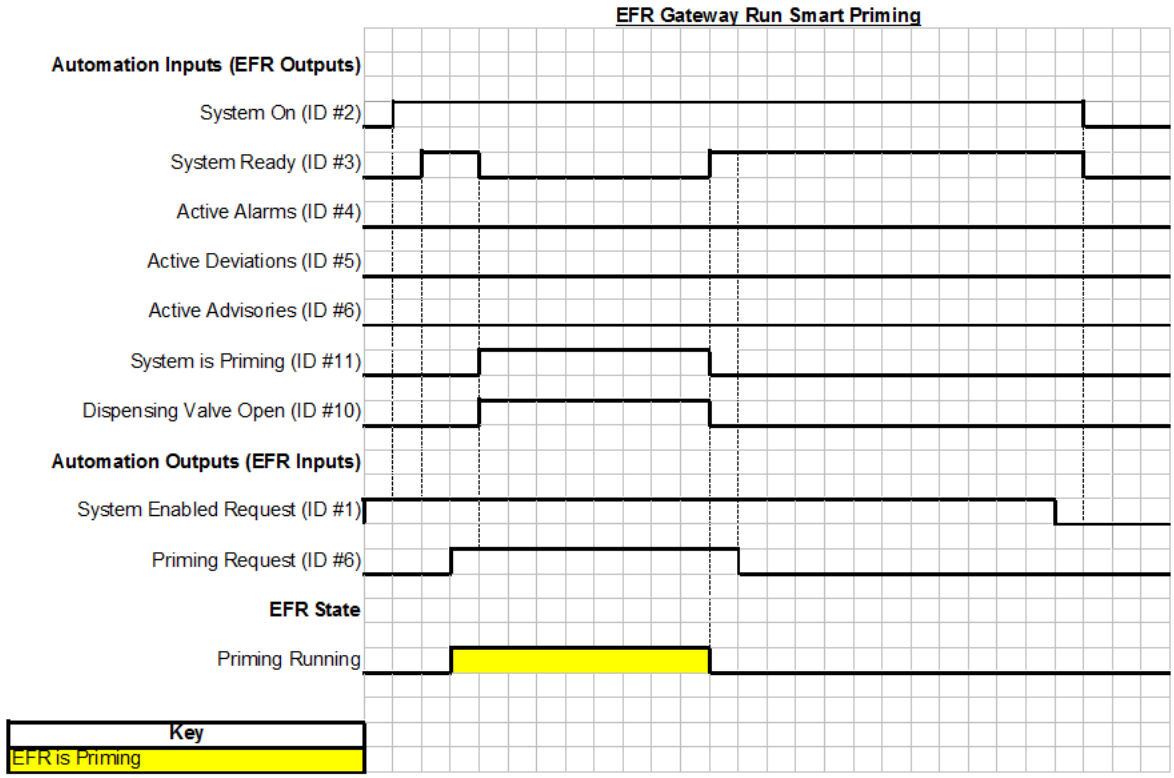
Automation Outputs (signals from PLC to EFR system)

Instance ID	Description	Data Type	BIT	Output Byte Index's
1	System Enable Request	Boolean	0	0
2	System Shutdown Request	Boolean	1	
3	Start Current Sequence/Step, Trigger Operator Mode	Boolean	2	
4	Pause Current Sequence	Boolean	3	
5	Stop Current Sequence	Boolean	4	
6	Priming Request	Boolean	5	
7	Purge Request	Boolean	6	
8	Parking Request	Boolean	7	
9	Depressurizing Request	Boolean	8	1
10	{Reserved Bits}	Boolean	9-15	
11	{Reserved Bits}	uint8	0-7	2
12	Desired Active Sequence	uint8	0-7	3
13	Acknowledging of the Active Error Number	uint8	0-7	4
14	Desired Operator Mode Dispense Flow Rate (XXXX cc/min)	uint16	0-7	5
			8-15	6
15	Data Exchanged Element Desired	uint8	0-7	7
16	Data Exchanged Element Desired Value	uint16	0-7	8
			8-15	9
17	Desired Step of the Active Sequence	uint8	0-7	10
19	Desired Step Amount (XXXX.XX)	uint32	0-7	11
			8-15	12
			16-23	13
			24-31	14
19	Desired Step Shot Type	uint8	0-7	15
20	Desired Step Flow Rate (XXXX cc/min)	uint16	0-7	16
			8-15	17
21	Desired Step Calibration (XX.XX)	uint16	0-7	18
			8-15	19
22	{Reserved Word}	uint16	0-7	20
			8-15	21

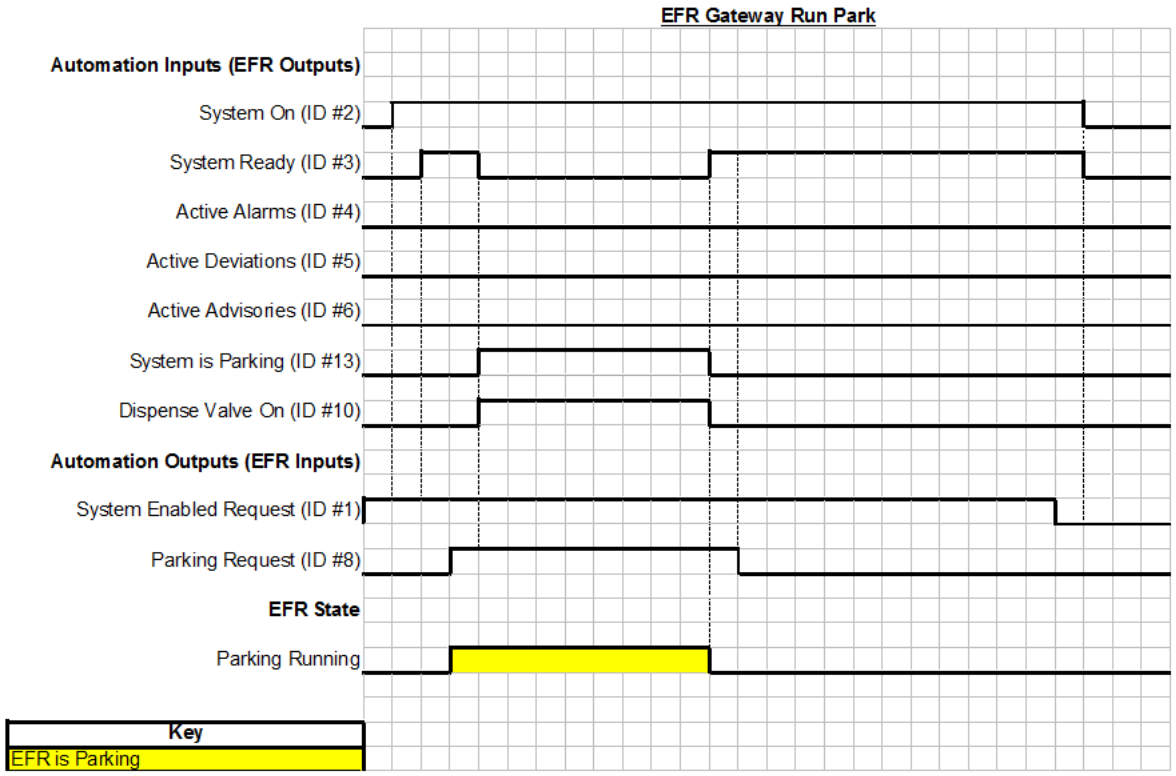
CGM General Timing Diagrams

NOTE: A 50ms delay is suggested between each CGM signal.

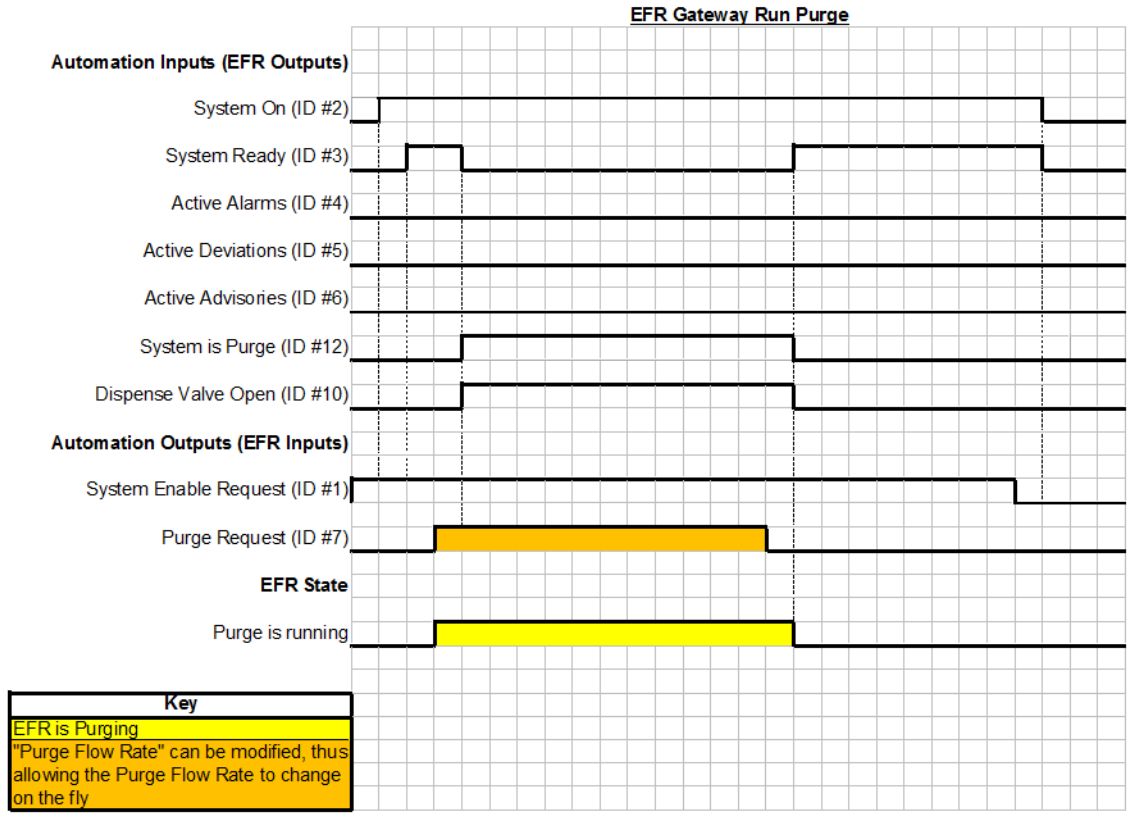
NOTE: In the diagrams shown below, the ID# corresponds to the Instance ID in the Automation Inputs and Outputs table.



When the Priming Request bit is ON, the EFR will start priming as long as the System On bit is also ON. If the System On bit or the Priming Request bit is OFF, the EFR will stop priming.

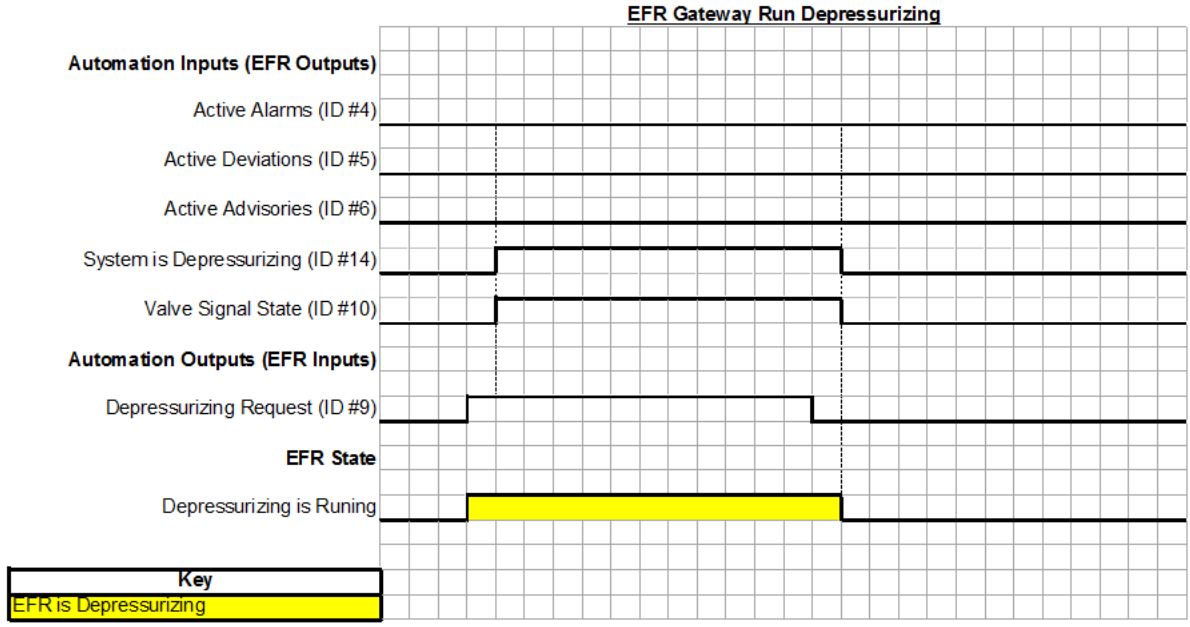


When the Parking Request bit is ON, the EFR will start parking as long as the System On bit is also ON. If the System On bit or the Parking Request bit is OFF, the EFR will stop parking.

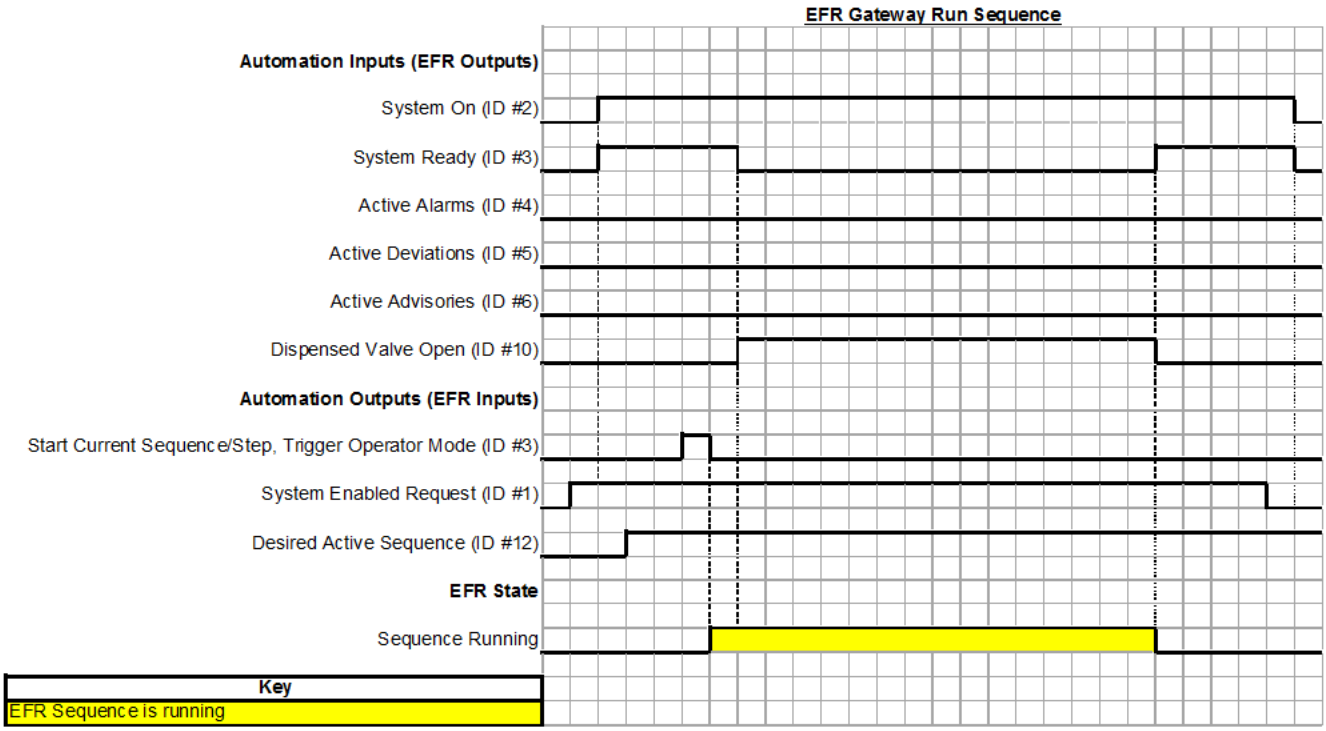


When the Purge Request bit is ON, the EFR will start purging as long as the System On bit is also ON. If the System On bit or the Purge Request bit is OFF, the EFR will stop purging.

The purge flow rate can be modified quickly through the data exchange.

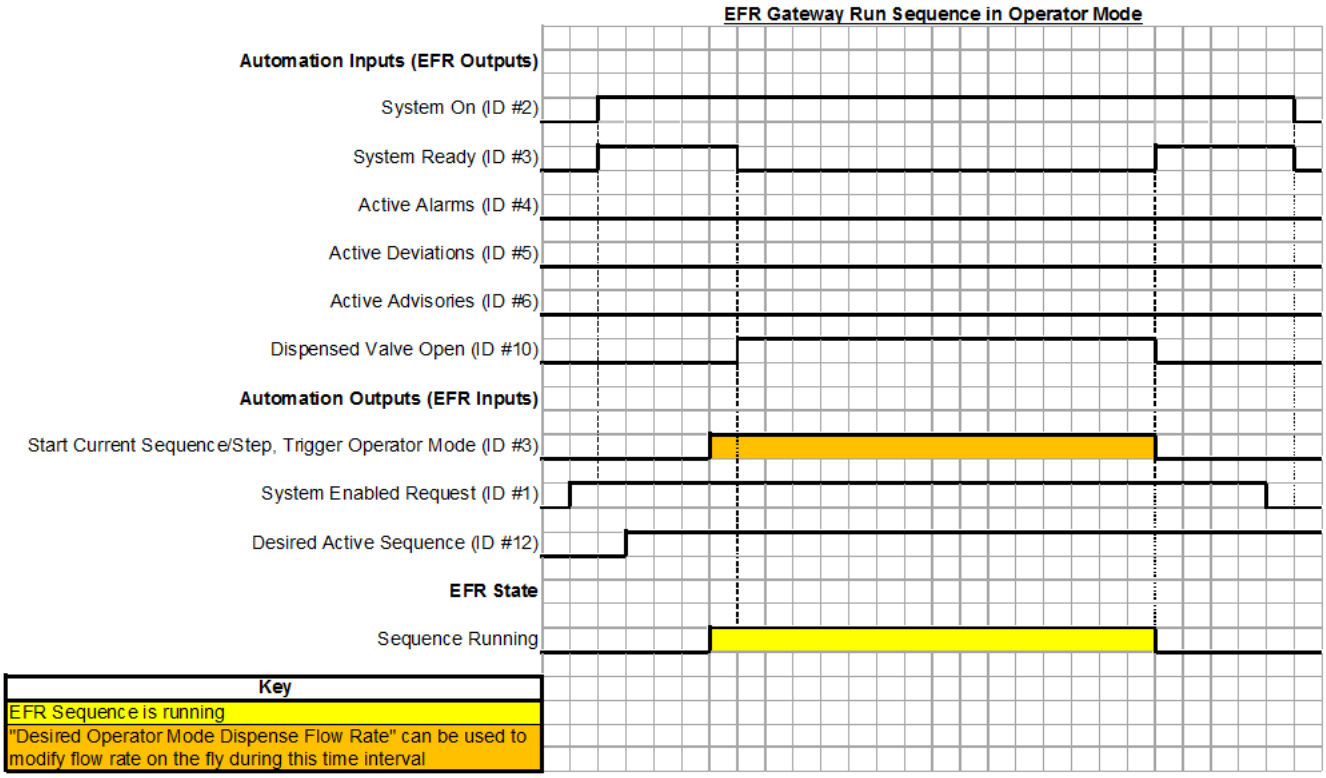


When the Depressurizing Request bit is ON, the EFR will start depressurizing. The EFR will only stop depressurizing if the Depressurizing Request bit if OFF.



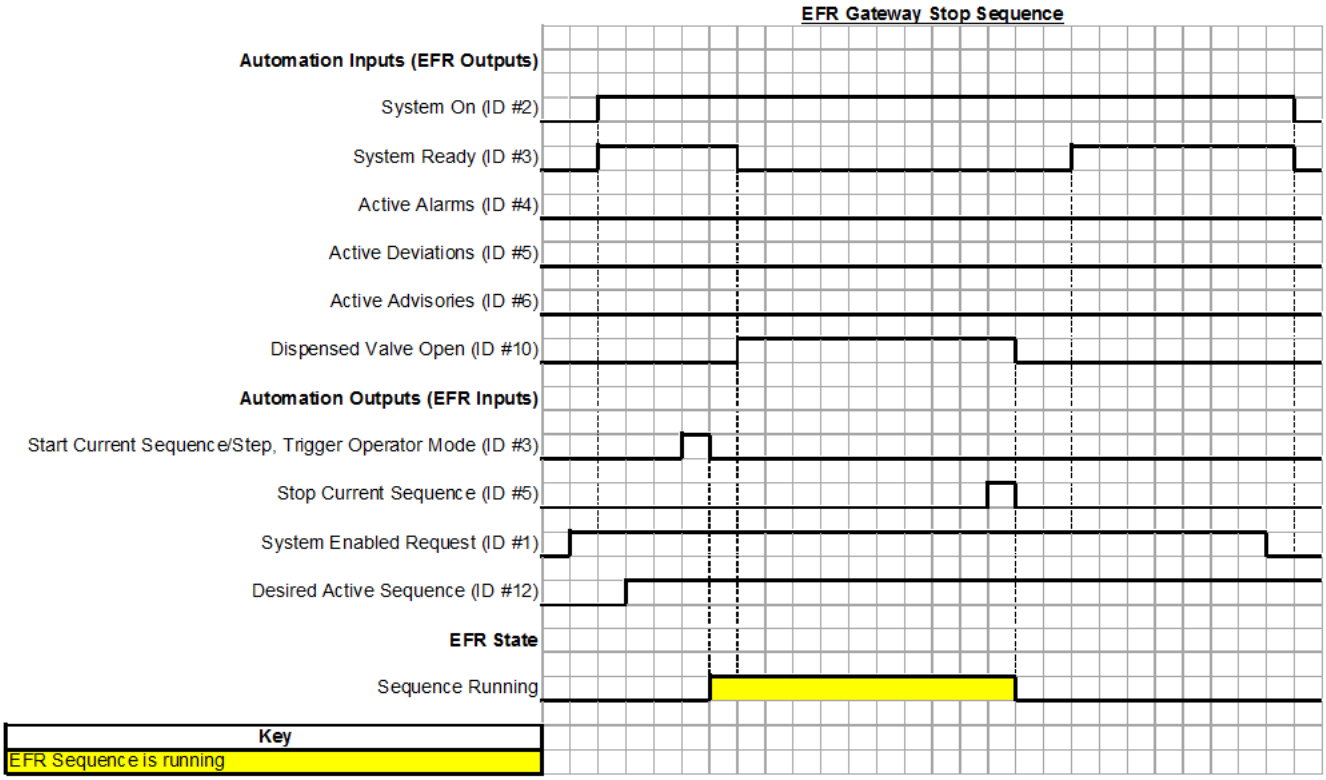
If the sequence is not in operator mode, a pulse on the Start Current Sequence/Step, Trigger Operator Mode bit will play the active sequence.

Sending the Desired Active Sequence byte is optional. If the The Desired Active Sequence byte is not sent, the current active sequence stored in the EFR will be used.



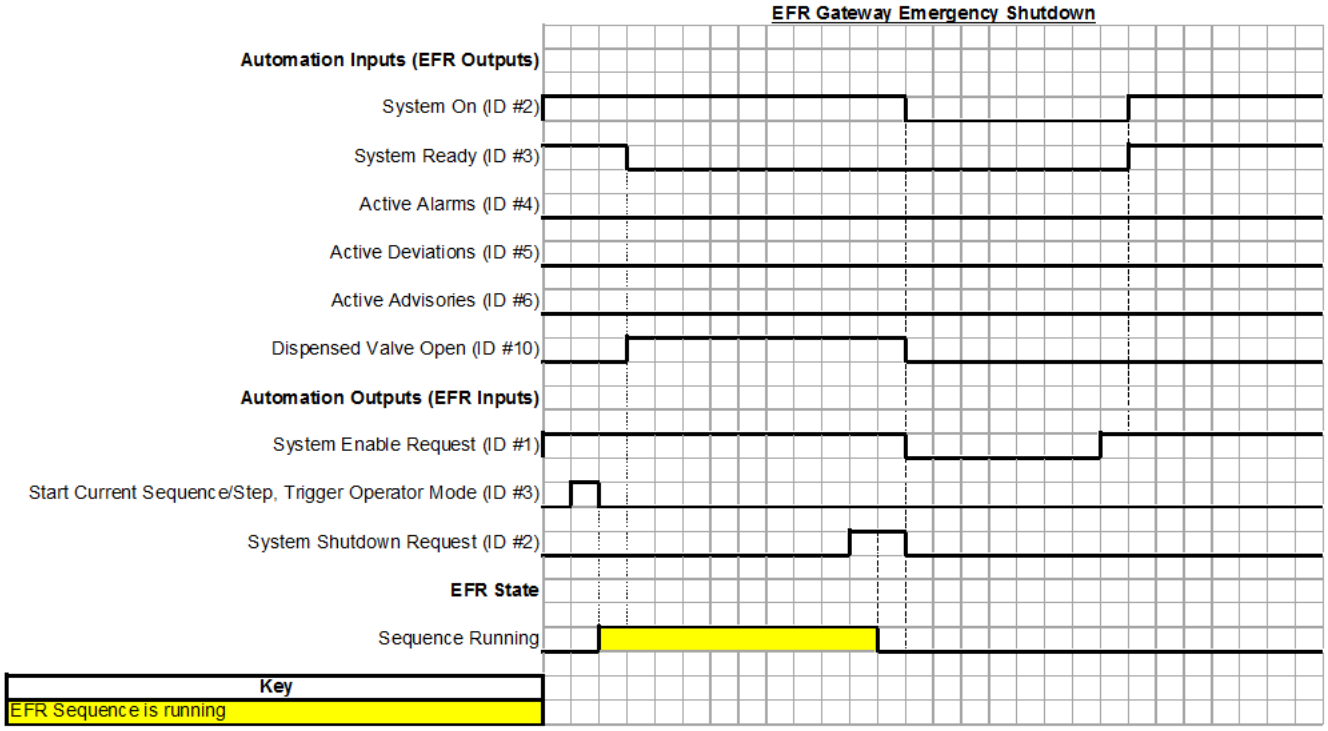
If there is a step in operator mode throughout the active sequence, the EFR will only dispense that step if the Start Current Sequence/Step, Trigger Operator Mode bit remains ON. Once the Start Current Sequence/Step, Trigger Operator Mode bit is OFF, the EFR will continue with the active sequence.

Sending the Desired Active Sequence byte is optional. If the The Desired Active Sequence byte is not sent, the current active sequence stored in the EFR will be used.



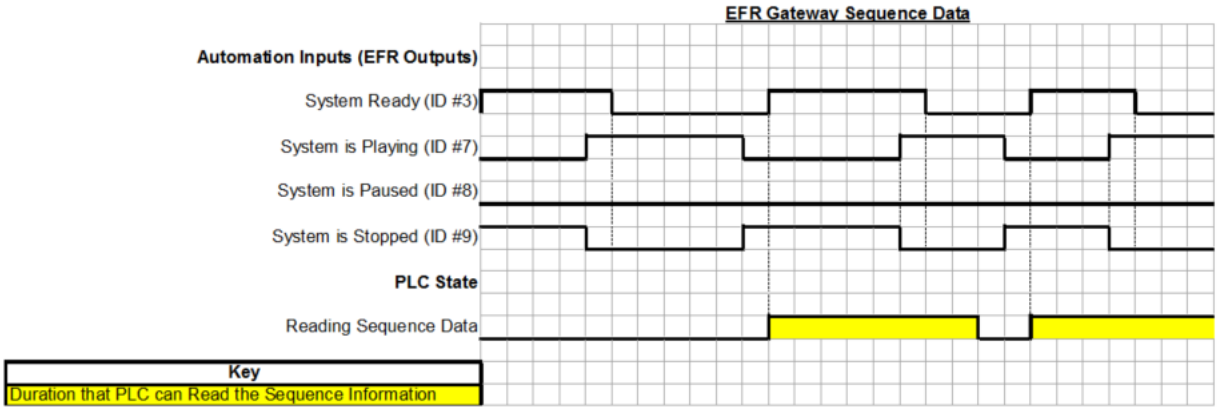
An ON pulse across the Stop Current Sequence bit will stop the active sequence.

Sending the Desired Active Sequence byte is optional. If the The Desired Active Sequence byte is not sent, the current active sequence stored in the EFR will be used.



An ON pulse across the System Shutdown Request bit will stop the sequence and turn the System On bit OFF, making the system inactive.

A toggle OFF followed by a toggle ON of the System Enabled Request bit will put the system back into the active state after the EFR has shut down.



The Sequence Data must be read before the EFR finishes running another sequence. If the Sequence Data is not read before finishing the sequence, the data will be overwritten with new Sequence Data.

The Sequence Data consists of:

- Total Sequence Amount Requested
- Total Sequence Amount Dispensed
- Sequence Start Outlet Pressure for Red Pump
- Sequence Start Outlet Pressure for Blue Pump
- Sequence End Outlet Pressure for Red Pump
- Sequence End Outlet Pressure for Blue Pump
- Sequence Inlet Pressure for Red Pump
- Sequence Inlet Pressure for Blue Pump

Appendix A - I/O Signal Descriptions

This section provides details about the CGM Automation Input and Output Signals.

Automation Inputs (signals from EFR system to PLC)

Heartbeat to PLC

Heartbeat to PLC is a Boolean signal that toggles at a frequency of 1 Hz. This signal toggles so the PLC can confirm the EFR is connected.

NOTE: The EFR is monitoring the fieldbus connection as well. If the fieldbus connection stops transferring data, the EFR will automatically shut down.

System On

System On is a Boolean signal that represents the active state of the machine.

NOTE: The system must be ON or active for the machine to dispense.

System Ready

System Ready State is a Boolean signal that represents when the machine is ready to receive the next command.

NOTE: the system will not be ready to receive the next command if the EFR is dispensing, loading a sequence, or if an active alarm is present.

Active Alarms

Active Alarms is a Boolean signal that represents the active alarms on the EFR.

NOTE: When an alarm is present, the EFR requires the operator's attention and will shut down immediately.

Active Deviations

Active Deviations is a Boolean signal that represents the active deviations on the EFR.

NOTE: When a deviation is present, the EFR is warning the operator of potential problem(s) that may need immediate attention to avoid shutdown time.

Active Advisories

Active Advisories is a Boolean signal that represents the active advisories on the EFR.

NOTE: When an advisory is present, the EFR is warning the operator of potential problem(s) that may need attention in the future to avoid shutdown time.

Current Sequence is Playing

Current Sequence is Playing is a Boolean signal that represents when the sequence is dispensing/running.

Current Sequence is Paused

Current Sequence is Paused is a Boolean signal that represents when the sequence is paused.

Current Sequence is Stopped

Current Sequence is Stopped is a Boolean signal that represents when the sequence is stopped.

Dispense Valve Open

Dispense Valve Open is a Boolean signal that represents when the valve is open.

System is Priming

System is Priming is a Boolean signal that represents when the system is priming.

System is Purging

System is Purging is a Boolean signal that represents when the system is purging.

System is Parking

System is Parking is a Boolean signal that represents when the system is parking.

System is Depressurizing

System is Depressurizing is a Boolean signal that represents when the system is depressurizing.

Gel Shot is Running

Gel Shot is Running is a Boolean signal that represents when the system is dispensing as a result of the gel timer.

EFR is Dispensing

EFR is Dispensing is a Boolean signal that represents when the system is dispensing.

Current Active Sequence

Current Active Sequence is an integer that represents the active sequence selected on the EFR.

Example: If the byte has a value of 33, sequence 33 is the active sequence selected.

Current Step of the Active Sequence

Current Step of the Active Sequence is an integer that represents the active step the EFR is currently running on the Current Active Sequence.

Example: If the byte has a value of 4, step 4 is the active step currently running.

Time Remaining to Complete Step

Time Remaining to Complete Step is a 16bit integer that represents the remaining time required to complete the Current Step of the Active Sequence.

Red Pump Outlet Pressure

Red Pump Outlet Pressure is a 16bit integer that represents the outlet pressure on the red pump.

Blue Pump Outlet Pressure

Blue Pump Outlet Pressure is a 16bit integer that represents the outlet pressure on the blue pump.

Red Pump Inlet Pressure

Red Pump Inlet Pressure is a 16bit integer that represents the inlet pressure on the red pump.

Blue Pump Inlet Pressure

Blue Pump Inlet Pressure is a 16bit integer that represents the inlet pressure on the blue pump.

Pump Flow Rate

Pump Flow Rate is a 16bit integer that represents the current flow rate of the pump.

Active Error Number Requiring Acknowledgment

See **Appendix D - Error Number Requiring Acknowledgment** on page 32.

Active Operator Mode Dispense Flow Rate

Active Operator Mode Dispense Flow Rate is a 16bit integer that represent the PCL desired flow rate for the EFR, which is used to override the flow rate of the operator mode step.

Data Exchange Element Selected

See **Appendix B - Data Exchanged** on page 24.

Data Exchange Element Value

See **Appendix B - Data Exchanged** on page 24.

Selected Step of the Active Sequence

See **Appendix C - Sequence Step Data Exchange** on page 30.

Selected Step Amount

See **Appendix C - Sequence Step Data Exchange** on page 30.

Selected Step Shot Type

See **Appendix C - Sequence Step Data Exchange** on page 30.

Selected Step Flow Rate

See **Appendix C - Sequence Step Data Exchange** on page 30.

Selected Step Calibration

See **Appendix C - Sequence Step Data Exchange** on page 30.

Total Sequence Amount Requested

Total Sequence Amount Requested is a 32bit integer that represent the amount requested by the EFR during the active sequence. This integer will only be populated after the active sequence finishes dispensing.

Total Sequence Amount Requested

Total Sequence Amount Dispensed is a 32bit integer that represent the amount dispensed by the EFR during the active sequence. This integer will only be populated after the active sequence finishes dispensing.

Automation Outputs (signals from PLC to EFR System)

System Enable Request

System Enable Request is a bit used to turn on/activate the system. It has the same function as the  button. Set this bit to 1 to turn on/activate the system, and set it to 0 to turn off/deactivate the system.

System Shutdown Request

System Shutdown Request is a bit used to immediately shut down the system. It has the same function as the  button. Set this bit to 1 to immediately shut down the EFR. Once the EFR has shut down, set this bit to 0 to clear the shutdown request.

Start Current Sequence/Step, Trigger Operator Mode

Start Current Sequence/Step, Trigger Operator mode is a bit used to play and trigger a sequence. Set this bit to 1 to start the sequence. Once the sequence is dispensing, set this bit to 0 to clear the request.

NOTE: When running in operator mode, this bit must remain high (1) for operator mode to be triggered. Once this bit is low (0), operator mode will be stopped and the EFR will continue with the active sequence.

Pause Current Sequence

Pause Current Sequence is a bit used to pause the active sequence. Set this bit to 1 to pause the current active sequence. Once the sequence is paused, set this bit to 0 to clear the request.

Stop Current Sequence

Stop Current Sequence is a bit used to stop the active sequence. Set this bit to 1 to stop the current active sequence. Once the sequence is stopped, set this bit to 0 to clear the request.

Priming Request

Priming Request is a bit used to turn the priming feature ON and OFF. Set this bit to 1 to start the smart priming feature. This bit can be set to 0 at any time during smart priming to stop the smart priming feature.

NOTE: Once the smart priming request is completed, set this bit to 0.

Purging Request

Purging Request is a bit used to turn the purging feature ON and OFF. Set this bit to 1 to turn the purging feature ON. When the PLC is ready to stop purging, set this bit to 0 to turn the purging feature OFF.

Parking Request

Parking Request is a bit used to turn the parking feature ON and OFF. Set this bit to 1 to start the parking feature. This bit can be set to 0 at any time while the pump is parking to stop the parking feature.

NOTE: Once the parking request is completed, set this bit to 0.

Depressurizing Request

Depressurizing Request is a bit used to turn the depressurizing feature on and off. Set this bit to 1 to turn the depressurize feature ON. When the PLC is ready to stop depressurizing, set this bit to 0 to turn the depressurizing feature OFF.

Desired Active Sequence

Desired Active Sequence is a byte used to request a new active sequence. If the value supplied is within the operable range, the value will be accepted by the EFR and reflected back to the Current Active Sequence of the Automation Inputs. The operable range of this byte corresponds to the number of sequences the EFR can hold, which is 1 to 50.

Acknowledging the Active Error Number

See **Appendix D - Error Number Requiring Acknowledgment** on page 32.

Desired Operator Mode Dispense Flow Rate

Desired Operator Mode Dispense Flow Rate is a byte used to request a new operator mode dispense flow rate to the EFR. If the value supplied is within the operable range and the EFR is running in operator mode, the value will be accepted by the EFR and reflected back to the Active Operator Mode Dispense Flow Rate of the Automation Inputs.

Data Exchange Element Desired

See **Appendix B - Data Exchanged** on page 24.

Data Exchange Element Desired Value

See **Appendix B - Data Exchanged** on page 24.

Desired Step of the Active Sequence

See **Appendix C - Sequence Step Data Exchange** on page 30.

Desired Step Amount

See **Appendix C - Sequence Step Data Exchange** on page 30.

Desired Step Shot Type

See **Appendix C - Sequence Step Data Exchange** on page 30.

Desired Step Flow Rate

See **Appendix C - Sequence Step Data Exchange** on page 30.

Desired Step Calibration

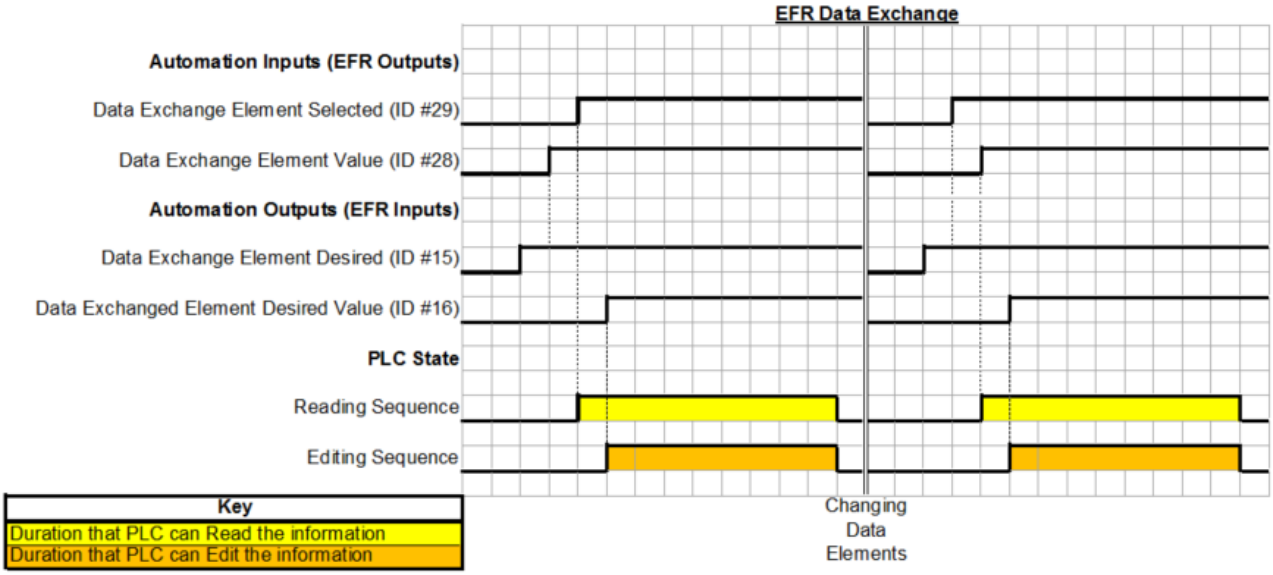
See **Appendix C - Sequence Step Data Exchange** on page 30.

Appendix B - Data Exchanged

The Data Exchange is a condensed structure used to read and edit a number of different variables in one data location. If multiple data exchanges are needed, they must be cycled through.

Below is a timing diagram showing the Data Exchange portion of EFR CGM Map.

NOTE: A 50ms delay is suggested between each CGM signal.



When the PLC needs to use the Data Exchange, the Data Exchange Element Desired must first be sent to the EFR. Initially, the Data Exchange Element Selected and the Data Exchange Element Value are set to zero to signal the data in the Data Exchange is invalid. Once the EFR returns the Data Exchange Element Value, followed by the Data Exchange Element Selected, the PLC can compare the Data Exchange Element Selected to the Data Exchange Element Desired and confirm the data is correct for the Data Exchange Element Desired. Once the Data Exchange Automation Inputs are confirmed, the Data Exchanged Element Desired Value can be used to request a new value. If the value supplied is within the operable range of the element, the EFR will accept the new value and will return that value to the Data Exchange Element Value.

EFR Data Exchange Elements

Data Exchange Element (base 10 integer)	Description	Data Type
1	Dispense Mode	uint8
2	ADM Rate Units	uint8
3	ADM Pressure Units	uint8
4	Pressure Imbalance Alarm Enabled	bool
5	Pressure Imbalance Alarm Level (XXXX.X bar)	uint16
6	Red Pump Size (XXX.XX cc)	uint16
7	Blue Pump Size (XXX.XX cc)	uint16
8	Red Pump Specific Gravity (X.XXX)	uint16
9	Blue Pump Specific Gravity (X.XXX)	uint16
10	Gel Timer Enabled	bool
11	Gel Timer Idle Period (XX s)	uint16
12	Gel Timer Alarm Period (XX s)	uint16
13	Gel Timer Repeat Sequence Until (XX cc)	uint16
14	Gel Timer Sequence Selected	uint8
15	Smart Prime Repeat Until (XX cc)	uint16
16	Smart Prime Sequence Selected	uint8
17	Purge Flow Rate (XXXX cc/min)	uint16
18	Over Pressure Alarm(XXXX.X bar)	uint16
20	Integration External Trigger Enabled	bool
21	Integration External Trigger Status	bool
22	Integration Smart Prime Enabled	bool
23	Integration Smart Prime Status	bool
24	Integration System Enabled	bool
25	Integration System Status	bool
26	Integration Analog Flow Rate Enabled	bool
27	Integration Analog Flow Rate Status (XXXX mV)	bool
28	Integration Sequence Selected Enabled	bool
29	Integration Sequence Selected Status	uint8
30	Red Pump Cycles (XXXX cycles)	uint16
31	Red Pump Lifetime Cycles (XXXX cycles)	uint16
32	Blue Pump Cycles (XXXX cycles)	uint16
33	Blue Pump Lifetime Cycles (XXXX cycles)	uint16
34	Dispense Valve Open Cycles (XXXX cycles)	uint16
35	Dispense Valve Open Lifetime Cycles (XXXX cycles)	uint16
36	Desired Number of Times to Run the Sequence	uint16
37	Actual Number of Times the Sequence has Ran	uint16
38	Mixed Material Specific Gravity (X.XXX)	uint16
39	Sequence Start Outlet Pressure for Red Pump (XXXX.X bar)	uint16
40	Sequence Start Outlet Pressure for Blue Pump (XXXX.X bar)	uint16
41	Sequence End Outlet Pressure for Red Pump (XXXX.X bar)	uint16
42	Sequence End Outlet Pressure for Blue Pump (XXXX.X bar)	uint16
43	Sequence Inlet Pressure for Red Pump (XXXX.X bar)	uint16
44	Sequence Inlet Pressure for Blue Pump (XXXX.X bar)	uint16

Below is a list of explanations of each individual Data Exchange Element.

Dispense Mode

Dispense Mode tells the EFR system whether the system is in weight or volume mode. The following values correspond to the various dispense modes offered by the EFR.

Value	Dispense Mode State
0	Weight Mode
1	Volume Mode

ADM Rate Units

ADM Rate Units tells the EFR system what units the rate will be displayed in on the ADM. The following values correspond to the various rate units the EFR ADM offers.

Value	Rate Units State
0	Per Minute
1	Per Second
2	Per Hour

ADM Pressure Units

ADM Pressure Units tells the EFR system what units the pressure will be displayed in on the ADM. The following values correspond to the various pressure units the EFR ADM offers.

Value	Pressure Units State
0	PSI
1	Bar

Pressure Imbalance Alarm Enabled

Pressure Imbalance Alarm Enabled is a boolean that can enable or disable the ability to view pressure imbalances between the red pump and the blue pump. The following values correspond to the different states the Pressure Imbalance Alarm boolean can be set to.

Value	Pressure Imbalance Alarm State
0	Not Enabled
1	Enabled

Pressure Imbalance Alarm Level

Pressure Imbalance Alarm Level is an integer used to trigger the pressure imbalance alarm.

Red Pump Size

Red Pump Size is an integer used to define the size of the red z pump.

Blue Pump Size

Blue Pump Size is an integer used to define the size of the blue z pump.

Red Specific Gravity

Red Specific Gravity is an integer used to define the specific gravity of the material in the red z pump.

Blue Specific Gravity

Blue Specific Gravity is an integer used to define the specific gravity of the material in the blue z pump.

Gel Timer Enabled

Gel Timer Enabled is a boolean that can enable or disable the Gel Timer feature. The following values correspond to the different states the Gel Timer boolean can be set to.

Value	Gel Timer Enabled State
0	Not Enabled
1	Enabled

Gel Timer Idle Period

Gel Timer Idle Period is an integer used to define the idle state of the gel timer before the gel timer causes a dispense.

Gel Timer Alarm

Gel Timer Alarm is an integer used to define the alarm state of the gel timer.

Gel Timer Repeat Unit

Gel Timer Repeat Unit is an integer used to define the amount of material dispensed for the gel timer shot.

Gel Timer Sequence Selected

Gel Timer Sequence Selected is an integer used to define the sequence that will run when the gel timer expires.

NOTE: To use the active sequence as the selected sequence for the gel timer, a new value of zero must be sent across the data exchange. If a new value of zero is not sent, the number sent across the data exchange will correspond to the sequence selected for the gel timer.

Smart Prime Repeat Unit

Smart Prime Repeat Unit is an integer used to define the amount of material dispensed for the smart prime.

Smart Prime Sequence Selected

Smart Prime Sequence Selected is an integer used to define the sequence that will run when smart prime is enabled.

NOTE: To use the active sequence as the selected sequence for smart prime, a new value of zero must be sent across the data exchange. If a new value of zero is not sent, the number sent across the data exchange will correspond to the sequence selected for the gel timer.

Purge Flow Rate

Purge Flow Rate is an integer used to define the flow rate at which the Purge Request will dispense.

Over Pressure Alarm

Over Pressure Alarm is an integer used to define the maximum pressure that can be reached before the EFR shuts down and returns the error.

Integration External Trigger Enabled

Integration External Trigger Enabled is a boolean that can enable usage of the Integration Trigger I/O pin. The following values correspond to the different states of the Integration External Trigger Enabled boolean.

Value	Integration Trigger Enabled State
0	Not Enabled
1	Enabled

Integration External Trigger Status

Integration External Trigger Status is a boolean that shows the status of the Integration Trigger I/O pin. The following values correspond to the different states of the Integration External Trigger Status boolean.

Value	Integration Trigger Status State
0	Not Active
1	Active

Integration Smart Prime Enabled

Integration Smart Prime Enabled is a boolean that can enable usage of the Integration Smart Prime I/O pin. The following values correspond to the different states of the Smart Prime Enabled boolean.

Value	Integration Smart Prime Enabled State
0	Not Enabled
1	Enabled

Integration Smart Prime Status

Integration Smart Prime Status is a boolean that shows the status of the Integration Smart Prime I/O pin. The following values correspond to the different states of the Smart Prime Status boolean.

Value	Integration Smart Prime Status State
0	Not Active
1	Active

Integration System Enabled

Integration System Enabled is a boolean that can enable usage of the Integration System I/O pin. The following values correspond to the different states of the Integration System Enabled boolean.

Value	Integration System Enabled State
0	Not Enabled
1	Enabled

Integration System Status

Integration System Status is a boolean that shows the status of the Integration System I/O pin. The following values correspond to the different states of the Integration System Status boolean.

Value	Integration System Status State
0	Not Active
1	Active

Integration Analog Flow Rate Enabled

Integration Analog Flow Rate Enabled is a boolean that can enable usage of the Integration Analog Flow Rate I/O pin. The following values correspond to the different states of the Integration Analog Flow Rate Enabled boolean.

Value	Integration Analog Flow Rate Enabled State
0	Not Enabled
1	Enabled

Integration Analog Flow Rate Status

Integration Analog Flow Rate Status is an integer used to define the voltage on the Analog Flow Rate I/O pin.

NOTE: This integer can only be read by the PLC.

Integration Sequence Selected Enabled

Integration Sequence Selected Enabled is a boolean that can enable usage of the Integration Sequence Selected I/O pins on the ADM. The following values correspond to the different states of the Sequence Selected Enabled boolean.

Value	Integration Sequence Selected Enabled State
0	Not Enabled
1	Enabled

Integration Sequence Selected Status

Integration Sequence Selected Status is an integer used to define the active sequence on the EFR by using I/O pins on the ADM as bits. When read, the integer results in the Active Sequence in the EFR system.

Example: If the integer has a value of 2, the Active Sequence is 2.

NOTE: This integer can only be read by the PLC.

Red Pump Cycles

Red Pump Cycles is an integer used to define the number of times the red pump has cycled. This can be reset by sending a value zero from the PLC over the Data Exchange.

Red Pump Lifetime Cycles

Red Pump Lifetime Cycles is an integer used to define the number of times the pump has cycled during its lifetime.

NOTE: This integer can only be read by the PLC.

Blue Pump Cycles

Blue Pump Cycles is an integer used to define the number of times the blue pump has cycled. This can be reset by sending a value zero from the PLC over the Data Exchange.

Blue Pump Lifetime Cycles

Blue Pump Lifetime Cycles is an integer used to define the number of times the pump has cycled during its lifetime.

NOTE: This integer can only be read by the PLC.

Dispense Valve Cycles

Dispense Valve Cycles is an integer used to define the number of times the dispense valve has opened. This can be reset by sending a value zero from the PLC over the Data Exchange.

Dispense Valve Lifetime Cycles

Dispense Valve Lifetime Cycles is an integer used to define the number of times the dispense valve has opened during its lifetime.

NOTE: This integer can only be read by the PLC.

Desired Number of Times to Run the Sequence

Desired Number of Times to Run the Sequence is an integer used to define the number of times the sequence will run.

Example: If the integer is 5, the sequence will run 5 times before the dispense is finished.

Actual Number of Times the Sequence has Ran

Actual Number of Times the Sequence has Ran is an integer used to define the number of times the sequence has run out of the desired number.

Example: If the integer is 10, the sequence has run 10 of X times. X represents the Desired Number of Times to Run the Sequence.

NOTE: This integer can only be read by the PLC.

Mixed Material Specific Gravity

Mixed Material Specific Gravity is an integer used to define the specific gravity of the mixed material.

NOTE: This integer can only be read by the PLC.

Sequence Start Outlet Pressure for Red Pump

Sequence Start Outlet Pressure for Red Pump is an integer that represents the outlet pressure of the red pump once the active sequence begins dispensing.

NOTE: This integer will only be populated after the active sequence is done dispensing.

NOTE: This integer can only be read by the PLC.

Sequence Start Outlet Pressure for Blue Pump

Sequence Start Outlet Pressure for Blue Pump is an integer that represents the outlet pressure of the blue pump once the active sequence begins dispensing.

NOTE: This integer will only be populated after the active sequence is done dispensing.

NOTE: This integer can only be read by the PLC.

Sequence End Outlet Pressure for Red Pump

Sequence End Outlet Pressure for Red Pump is an integer that represents the outlet pressure of the red pump once the active sequence is done dispensing.

NOTE: This integer will only be populated after the active sequence is done dispensing.

NOTE: This integer can only be read by the PLC.

Sequence End Outlet Pressure for Blue Pump

Sequence End Outlet Pressure for Blue Pump is an integer that represents the outlet pressure of the blue pump once the active sequence is done dispensing.

NOTE: This integer will only be populated after the active sequence is done dispensing.

NOTE: This integer can only be read by the PLC.

Sequence Inlet Pressure for Red Pump

Sequence Inlet Pressure for Red Pump is an integer that represents the inlet pressure of the red pump for the current sequence being dispensed.

NOTE: This integer will only be populated after the active sequence is done dispensing.

NOTE: This integer can only be read by the PLC.

Sequence Inlet Pressure for Blue Pump

Sequence Inlet Pressure for Blue Pump is an integer that represents the inlet pressure of the blue pump for the current sequence being dispensed.

NOTE: This integer will only be populated after the active sequence is done dispensing.

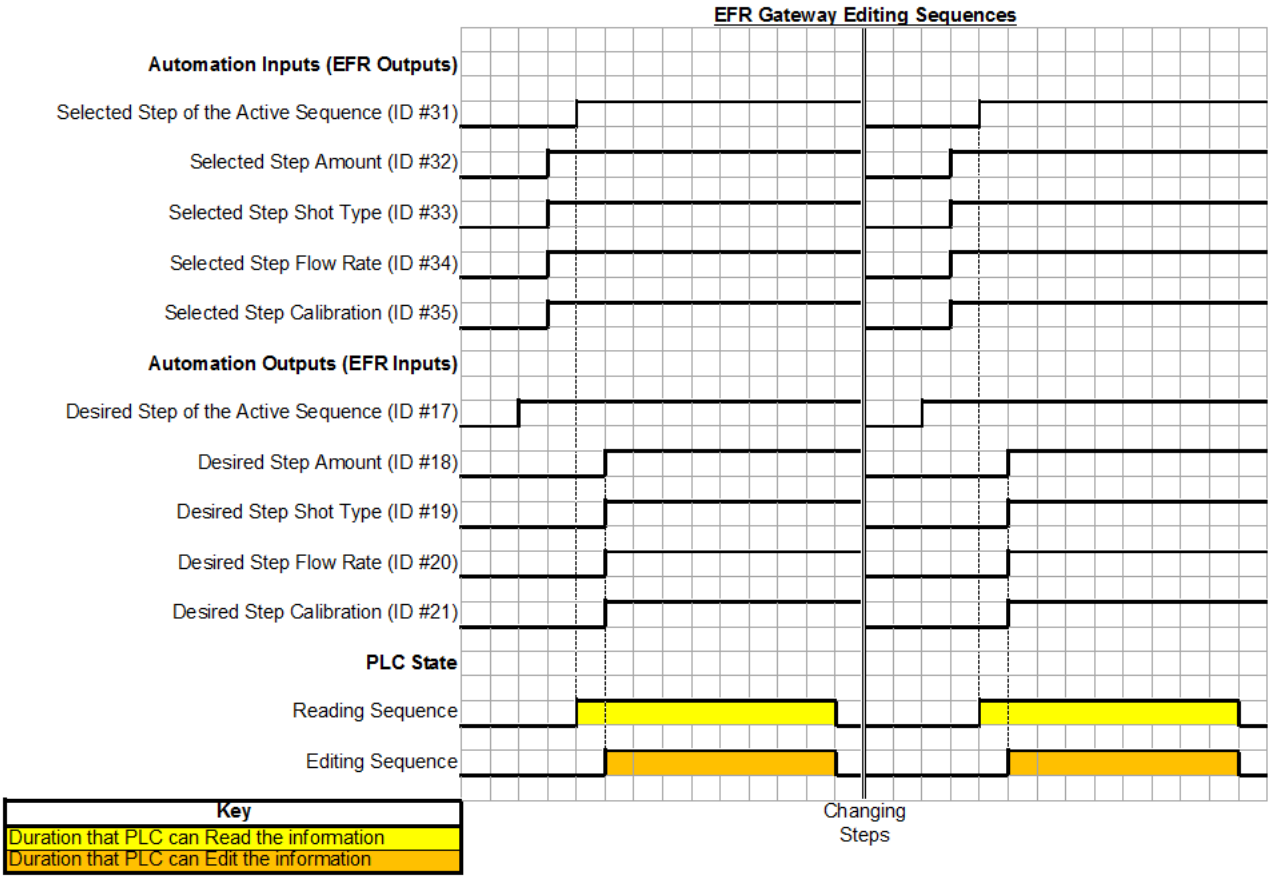
NOTE: This integer can only be read by the PLC.

Appendix C - Sequence Step Data Exchange

The Sequence Data Exchange is a condensed structure used to read and edit a number of steps in a sequence across a set of bytes. If multiple steps of sequences are needed, they must be cycled through.

Below is a timing diagram showing the Sequence Step Data Exchange portion of EFR CGM Map.

NOTE: A 50ms delay is suggested between each CGM signal.



When utilizing the Sequence Step Data Exchange, the first element that must be passed to the EFR is the Desired Step of the Active Sequence. Once the EFR receives that element, the EFR will update the Sequence Step Data Exchange Automation Inputs Elements for the desired step. After the Sequence Step Data Exchange Automation Inputs Elements have been updated, the Selected Step of the Active Sequence can be used to confirm the desired step data has populated the Sequence Step Data Exchange Automation Inputs Elements. Once the data has been confirmed for the desired step, the Sequence Step Data Exchange Automation Outputs Elements can be used to request new values to the EFR. If the values supplied are within the operable range of the elements, the EFR will accept the values and reflect the new values to the corresponding elements of the Sequence Step Data Exchange Automation Inputs Elements.

Sequence Step Data Exchange Automation Inputs Elements consist of:

- Selected Step of the Active Sequence
- Selected Step Amount
- Selected Step Shot Type
- Selected Step Flow Rate
- Selected Step Calibration

Sequence Step Data Exchange Automation Outputs Elements consist of:

- Desired Step of the Active Sequence
- Desired Step Amount
- Desired Step Shot Type
- Desired Step Flow Rate
- Desired Calibration

See the **EFR Sequence Step Data Exchange Elements** for further explanations of the Sequence Step Data Exchange Automation Outputs Elements and Sequence Step Data Exchange Automation Inputs Elements.

NOTE: If the Desired Step of the Active Sequence changes, the process of the Sequence Step Data Exchange will start over again, as shown in the timing diagram.

EFR Sequence Step Data Exchange Elements

Desired/Selected Step of the Active Sequence

Desired/Selected Step of the Active Sequence is a byte used to define the sequence step information that can be edited or read through the other elements of the sequence step data exchanged. When reading or writing to this element, the value will correspond with the step that can be read or edited.

Example: If 3 is shown, step 3 can be edited or read.

Desired/Selected Step Amount

Desired/Selected Step Amount is a 32bit integer used to define the step amount for the Desired Selected Step of the Active Sequence. When reading or writing to this element, the sequence step amount has two decimal places, and the units are always reflected by the integer in Selected Sequence Step Shot Type.

Desired/Selected Step Shot Type

Desired/Selected Step Shot Type is a byte used to define the step type for the Desired Selected Step of the Active Sequence. The table below shows the corresponding values and units that can be written or read from the EFR.

Value	Sequence Step Type State	Units
0	Step CC Continue*	cc
1	Step Grams Continue*	grams
2	Step Seconds Continue*	seconds
3	Step CC Break**	cc
4	Step Grams Break**	grams
5	Step Seconds Break**	seconds
6	Operator Mode	N/A

* *Continue means the EFR will not wait on an external trigger from the Trigger I/O pin or the Start Current Sequence/Step, Trigger Operator Mode bit. The EFR will immediately continue into that step.*

** *Break means the EFR will wait on an external trigger from the Trigger I/O pin or the Start Current Sequence/Step, Trigger Operator mode bit before moving into that step.*

Desired/Selected Step Flow Rate

Desired/Selected Step Flow Rate is a 16bit integer used to define the step flow rate for the Desired Selected Step of the Active Sequence.

Desired/Selected Step Calibration

Desired/Selected Step Calibration is a 16bit signed integer used to define the step calibration for the Desired Selected Step of the Active Sequence. The units for this are always reflected by the integer in the Selected Sequence Step Shot Type.

Appendix D - Error Number Requiring Acknowledgment

The Error Number Requiring Acknowledgment is a structure that allows the PLC to monitor, acknowledge and clear errors on the EFR system.

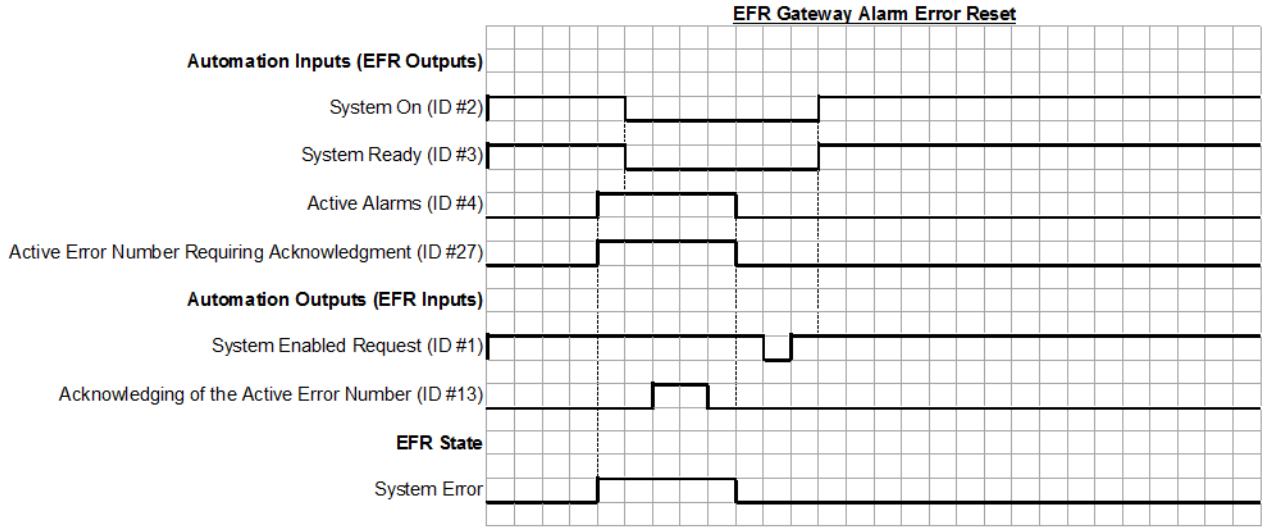
Below is a list of errors the EFR can return through the CGM. If active, each error will return a value to the Active Error Number Requiring Acknowledgment location of the map. See the Error Value column for the corresponding value of each error. When an error is returned through the Active Error Number Requiring Acknowledgment location of the map, the error must be acknowledged. To acknowledge an error, the value of the error that was returned must be copied to the Acknowledging of the Active Error Number location of the map. Once the error value has been copied and sent, the EFR will clear the error and will not update the Active Error Number Requiring Acknowledgment location until the error has been cleared inside the EFR.

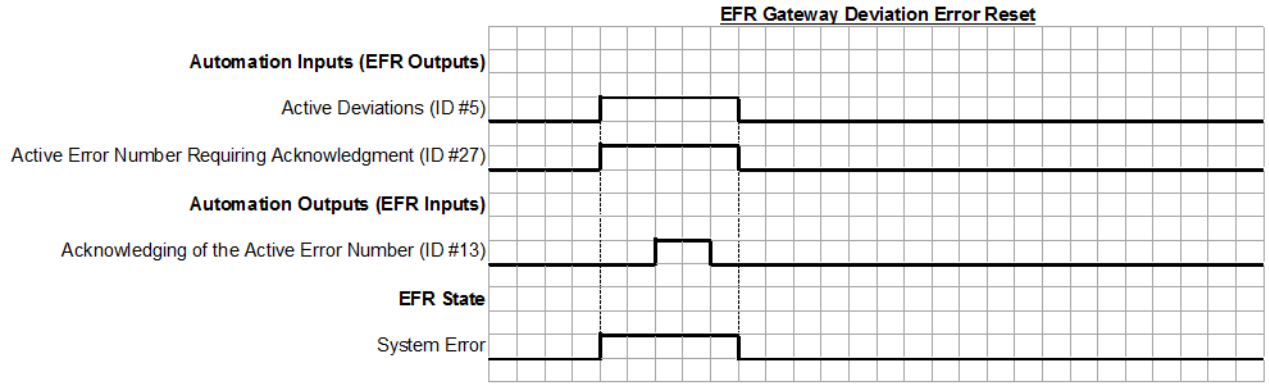
NOTE: See the timing diagrams below for information regarding the timing of signals. A 50ms delay is suggested between each CGM signal.

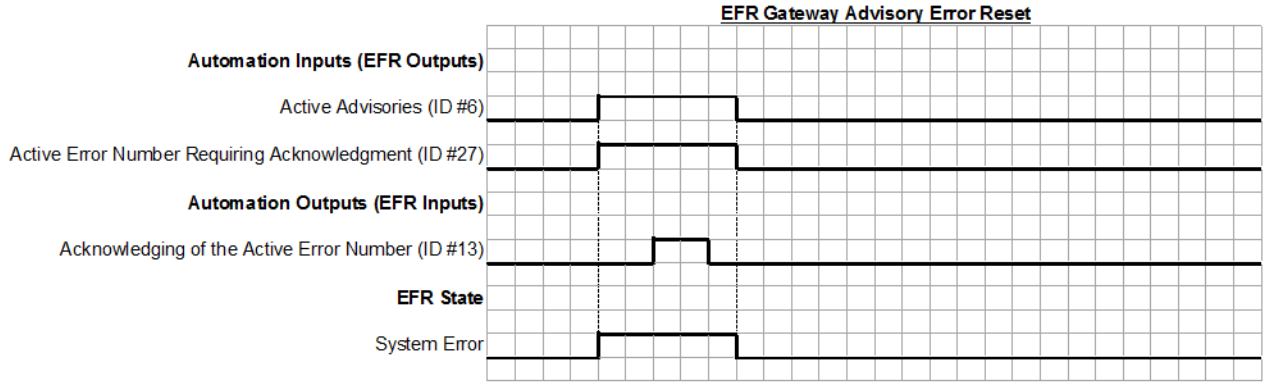
NOTE: See help.graco.com for further explanation of each error code.

Error Code	Error Description	Error Type	Error Value
P4DA	High Pressure Red Side	Alarm	1
P4DB	High Pressure Blue Side	Alarm	2
P6DA	Red Pressure Disconnected	Alarm	3
P6DB	Blue Pressure Disconnected	Alarm	4
P7DA	Pressure Imbalance Red Side	Alarm	5
P7DB	Pressure Imbalance Blue Side	Alarm	6
V1NX	Motor Under Voltage	Alarm	8
V4NX	Motor Over Voltage	Alarm	9
T4NX	Motor Temperature	Alarm	10
T4NX	Motor Board Temperature	Alarm	11
WBNX	Motor Encoder	Alarm	12
WMNX	Motor IPC Communication	Alarm	13
WMNX	Motor Board Hardware	Alarm	14
WMNX	Motor Board Exception	Alarm	15
A4NX	Motor Switch Current	Alarm	16
P3DA	High Pressure Red Side Warning	Deviation	17
P3DB	High Pressure Blue Side Warning	Deviation	18
S1NX	Invalided Sequence Step Warning	Deviation	19
W5NX	Motor Encoder Calibration Warning	Deviation	20
CACA	ADM Disconnected	Advisory	21
CACF	FCM Disconnected	Advisory	22
CACM	Motor Disconnected	Advisory	23
CACC	CGM Disconnected	Advisory	24
CCCC	CGM Fieldbus Disconnected	Advisory	26
P6FA	Inlet Pressure Red Side Disconnected	Advisory	27
P6FB	Inlet Pressure Blue Side Disconnected	Advisory	28
DHDA	Leak Detected Red Side	Advisory	30

DHDB	Leak Detected Blue Side	Advisory	31
F3NX	High Flow Rate	Advisory	32
P4FA	High Inlet Pressure Red Pump	Advisory	33
P4FB	High Inlet Pressure Blue Pump	Advisory	34
DDDA	Red Pump Cavitation	Advisory	35
DDDB	Blue Pump Cavitation	Advisory	36
DBDX	Bubble Detected	Advisory	37
P4FX	High Inlet Pressure	Advisory	38







Graco Standard Warranty

Graco warrants all equipment referenced in this document which is manufactured by Graco and bearing its name to be free from defects in material and workmanship on the date of sale to the original purchaser for use. With the exception of any special, extended, or limited warranty published by Graco, Graco will, for a period of twelve months from the date of sale, repair or replace any part of the equipment determined by Graco to be defective. This warranty applies only when the equipment is installed, operated and maintained in accordance with Graco's written recommendations.

This warranty does not cover, and Graco shall not be liable for general wear and tear, or any malfunction, damage or wear caused by faulty installation, misapplication, abrasion, corrosion, inadequate or improper maintenance, negligence, accident, tampering, or substitution of non-Graco component parts. Nor shall Graco be liable for malfunction, damage or wear caused by the incompatibility of Graco equipment with structures, accessories, equipment or materials not supplied by Graco, or the improper design, manufacture, installation, operation or maintenance of structures, accessories, equipment or materials not supplied by Graco.

This warranty is conditioned upon the prepaid return of the equipment claimed to be defective to an authorized Graco distributor for verification of the claimed defect. If the claimed defect is verified, Graco will repair or replace free of charge any defective parts. The equipment will be returned to the original purchaser transportation prepaid. If inspection of the equipment does not disclose any defect in material or workmanship, repairs will be made at a reasonable charge, which charges may include the costs of parts, labor, and transportation.

THIS WARRANTY IS EXCLUSIVE, AND IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.

Graco's sole obligation and buyer's sole remedy for any breach of warranty shall be as set forth above. The buyer agrees that no other remedy (including, but not limited to, incidental or consequential damages for lost profits, lost sales, injury to person or property, or any other incidental or consequential loss) shall be available. Any action for breach of warranty must be brought within two (2) years of the date of sale.

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Sealant and Adhesive Dispensing Equipment

For the latest information about Graco products, visit www.graco.com.
For patent information, see www.graco.com/patents.
TO PLACE AN ORDER, contact your Graco distributor, go to www.graco.com, or call to identify the nearest distributor.

If calling from the USA: 1-800-746-1334

If calling from outside the USA: 0-1-330-966-3000

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Original instructions. This manual contains English. MM 3A6338
Graco Headquarters: Minneapolis
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