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# CM0212 Multi-Function Application User Guide

Smart Node Controller Module

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## Revision History

Rev #	Description of change	Date
01	Initial release – first draft of customer requirements.	10/2/2024

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# 1. Safety

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Do not perform the procedures in this manual unless you are experienced in the handling of electronic equipment.

Contact the manufacturer if there is anything you are not sure about or if you have any questions regarding the product and its handling or maintenance.

The term "manufacturer" refers to Parker Hannifin Corporation.

## 1.1. Safety symbols

The following symbols are used in this document to indicate potentially hazardous situations:




 *Danger! Risk of death or injury.*

 *Warning! Risk of damage to equipment or degradation of signal*

When you see these symbols, follow the instructions carefully and proceed with caution.

## 1.2. General safety regulations

Work on the hydraulic control electronics may only be carried out by trained personnel who are well-acquainted with the control system, the machine, and its safety regulations.

-  Follow the manufacturer's recommendations when mounting, modifying, repairing, and maintaining equipment. The manufacturer assumes no responsibility for any accidents caused by incorrectly mounted or incorrectly maintained equipment. The manufacturer assumes no responsibility for the system being incorrectly applied, or the system being programmed in a manner that jeopardizes safety.
-  Do not use the product if electronic modules, cabling, or connectors are damaged or if the control system shows error functions.
-  Electronic control systems in an inappropriate installation and in combination with strong electromagnetic interference fields can, in extreme cases, cause an unintentional change of speed of the output function.

### 1.3. Welding after installation

Complete welding work on the chassis before the installation of the control system. If welding must be done afterwards, proceed as follows:


 Do not place the welding unit cables near the electrical wires of the control system.

- Disconnect the electrical connections between the system and external equipment.
- Disconnect the negative cable from the battery.
- Disconnect the positive cable from the battery.
- Connect the welder's ground wire as close as possible to the place of the welding.



### 1.4. Construction regulations

The vehicle should be equipped with an emergency stop which disconnects the supply voltage to the control system's electrical units, where regulations require. The emergency stop must be easily accessible to the operator. If possible, the machine should be built so the control system work function outputs are disabled when the operator leaves the operating station.

### 1.5. Safety during installation

 Incorrectly positioned or mounted cabling can be influenced by radio signals which can interfere with the functions of the system.

### 1.6. Safety during start-up

-  ***Danger! Risk of death or injury.*** Do not start the machine's engine before the control system is mounted and its electrical functions have been verified.
-  Do not start the machine if anyone is near the machine.

### 1.7. Safety during maintenance and fault diagnosis

Before performing any work on the hydraulic control electronics, ensure that:

- The machine cannot start moving.
- Functions are positioned safely.
- The machine is turned off.
- The hydraulic system is relieved of any pressure.
- Supply voltage to the control electronics is disconnected.

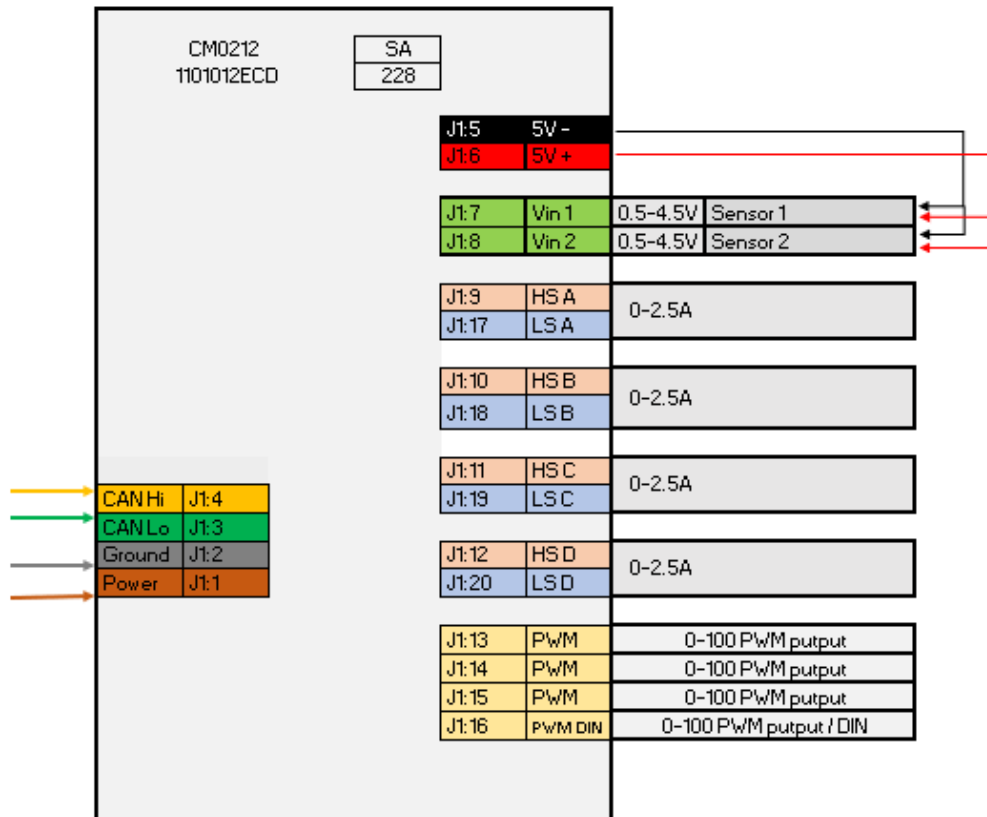
## 2. CM0212 Multi-Function Controller Specification

The CM0212 multi-function controller is designed to control multiple types of electrohydraulic components. The controller is preprogrammed with standard methods of controlling systems including open and closed loop control, as well as proportional and digital control.

The configuration described in this manual has one (1) CAN bus, one (1) 5V sensor supply, two (2) inputs, and 12 outputs.



Figure: CM0212 controller module



## 2.1. Key Specifications

<b>General</b>	
Weight	0.21 kg
Operating Temperature	-40°C to +85°C
Storage Temperature	-40°C to +85°C
<b>Electrical</b>	
System Voltage	12 V
Operating Voltage	9 V to 16 V
Micro Core Capabilities	
Micro Type	STM32F407 (Cortex M4 based)
Flash Size	1024 kB
RAM Size	192 kB
EEPROM Size	8 kB
Communication Channels	
CAN (SAE J1939)	1
Configurable Inputs*	Maximum of 2 inputs
Analog Inputs	Input Sensor: Analog and/or Frequency
Outputs	
High Side Outputs - PWM capable	8
Max Continuous Load per Output	2.5 A
Max PWM Frequency	250 Hz
Low Side Outputs	4
Max Continuous Load per Output	2.5 A (with current sense)
+5V Sensor Supply	1 (5 V at 75 mA max current)
Maximum Module Current	10 A
<b>Mechanical</b>	
Enclosure Material	Injection Molded Plastic with potted electronics
Connector	1 x 20 pins
Type	Molex MX150, Key B
Mounting Method	Two 1/4" or 6mm bolts
<b>Software</b>	
Application Software	Preprogrammed with J1939 parameterized software
Configurable Software	Simple I/O configuration is provided via CAN communication
<b>Environment</b>	
Specifications (based on)	EP455, MIL-STD-202G, EN7691, ISO 10605, and ISO 14982
Sealing	IP69K
Over Voltage	26V
<b>Ordering</b>	
Ordering Part Number	1101002ECD

## 2.2. Theory of Operation

Each unit will have the capability to do four instances of current control through a highside / lowside driver pair and an additional four (4) highside outputs for open loop control. There can be up to 24 instances of this unit on a CAN bus. A master unit will send a demand percentage to the unit corresponding to the desired output for each of the 4 four (4) driver pairs over CAN as well as for each of the 4 four (4) highside open loop drivers. Each unit will have the capability to do two (2) analog inputs (0 ~ 5V). One of the two inputs has alternate configuration to measure frequency.

The 1101002ECD controller is designed as a preprogrammed valve driver with the following:

- Assignable source address
- Adjustable closed loop current control
- Single point sensor calibration for both inputs
- PID control for input controlled output
- Adjustable look-up tables for each current control output
- Adjustable current ranges and ramps for each output
- Fail to max / fail to min settings
- Operating modes
  - Proportional based on CAN command
  - Closed loop based on input
  - ON/OFF & set point control
  - Direct proportional control based on input
  - Stand alone controller mode for direct proportional control output with Safety Switch

## 3. CM0212 Installation Guide

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Because every system is different, it is not feasible to provide detailed installation instructions that will be suitable for every assembly. This chapter therefore provides a few examples showing the use of the CM0212 to control different types of motion control products and subsystems.

 The vehicle manufacturer is responsible for creating procedures for mounting the CM0212 in a vehicle during production assembly.

### 3.1. Mechanical Requirements

Review the following mechanical requirements before selecting a mounting location for the CM0212:

- The CM0212 should be mounted vertically so fluids will drain away from it.
- The wire harness should have drip loops incorporated into the design to divert fluids away from the CM0212.
- The harness should be shielded from harsh impact.
- The harness should connect easily to the connector and have adequate bend radius.
- The labels should be easy to read.
- The CM0212 should be in a location that is easily accessible for service.
- Secure the CM0212 with bolts in all bolt holes using Hex Head or equivalent metric size (M6) bolts.
- The bolts should be tightened according to the fastener manufacturer's tightening torque specifications.

### 3.2. Dimensions

The following shows the dimensions of the CM0212 in millimeters:

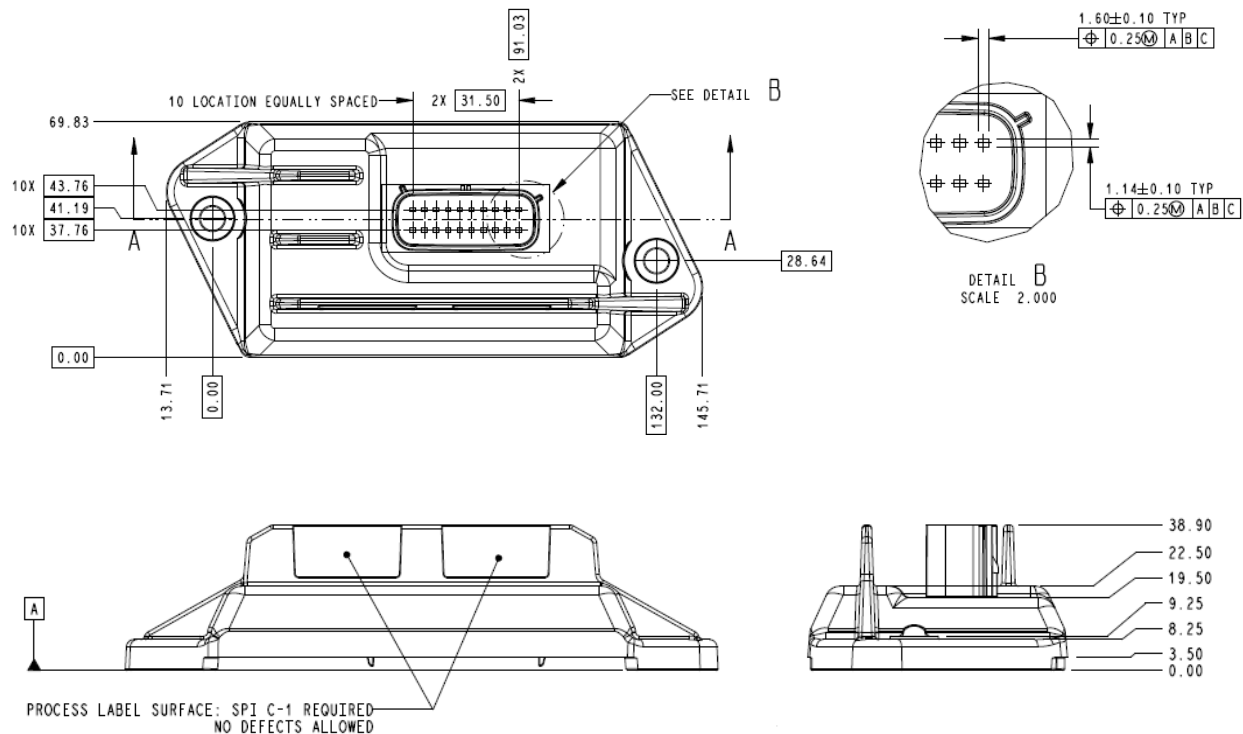


Figure: CM0212 dimensions

### 3.3. Selecting a Mounting Location

The CM0212 can be installed in the vehicle's cab, engine compartment, or on the chassis.

Before mounting the CM0212, ensure you review the following environmental and mechanical requirements.

**⚠ Caution:** Do not install the CM0212 close to any significant heat sources, such as a turbo, exhaust manifold, etc. Also avoid installing the CM0212 near any drive-train component, such as a transmission or engine block.

The CM0212 should be mounted so that fluids drain away from the connector, as shown in the following:

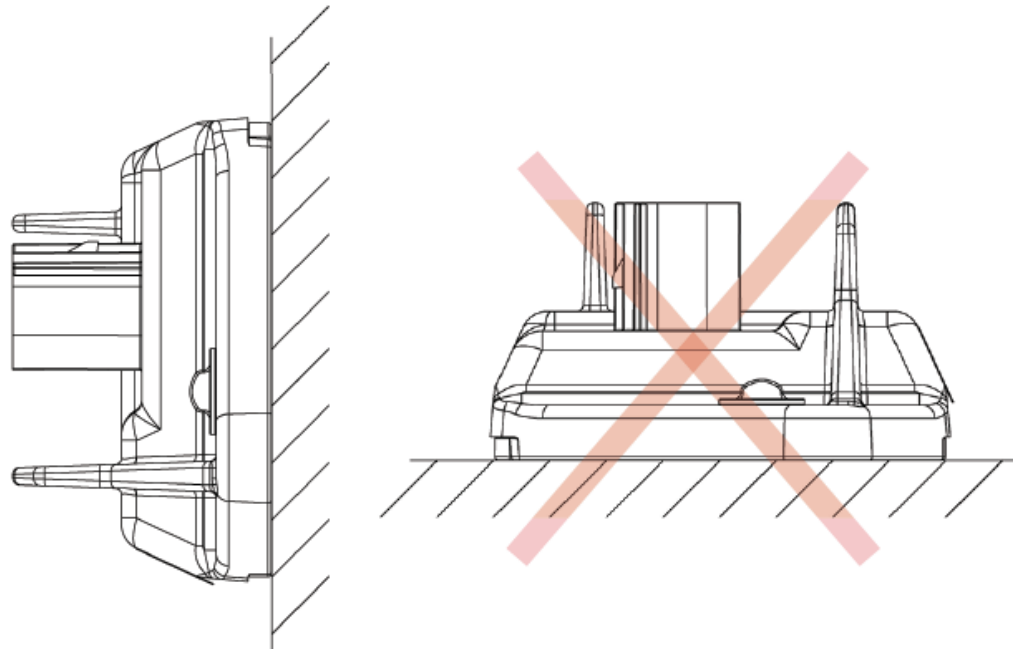


Figure: Recommended mounting orientation

### 3.4. Designing and Connecting the Vehicle Harness

The vehicle manufacturer is responsible for designing a vehicle harness that mates with the CM0212 connector(s).

The vehicle harness design depends on the following:

- How the CM0212's inputs, outputs, communication, and power pins are configured.
- Other components on the vehicle and their physical locations.
- The routing of the harness.

Details on recommended wire diameters for use with the product connector are covered in the connector manufacturer's datasheet. Wire diameters used should be sufficient for the expected module current.

Once the vehicle harness is designed, it can be connected to the CM0212 simply by clicking the mating connectors onto the connector ports on the CM0212.

## 4. Input and Output Descriptions

### 4.1. Implementing Interlock

When implemented as a standalone controller, PIN16 can be utilized as an interlock to enable operation. This feature can be implemented with the CM0212 to ensure the vehicle does not move when it is not being used and no one is sitting in the operator's seat.

To prevent the vehicle from moving when no one is sitting in the operator seat, place a seat switch interlock on the operator seat and connect the switch to a digital input (PIN16).

The following diagram shows a typical seat switch interlock connection:

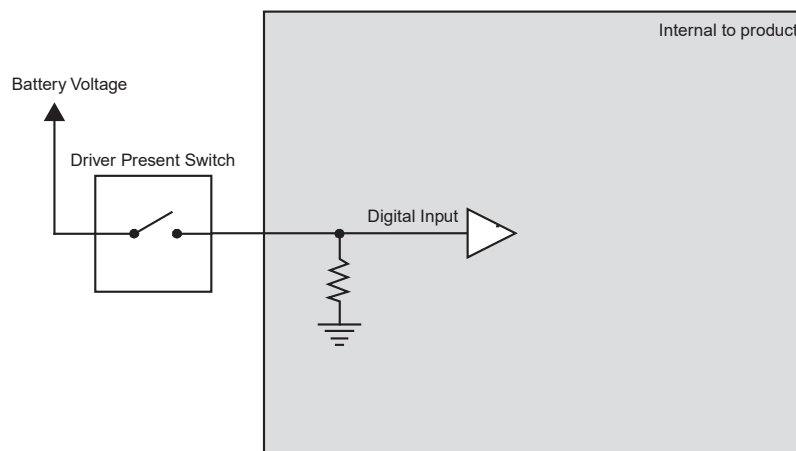


Figure1: Seat switch interlock connection

## 4.2. Controlling a Proportional Valve

The CM0212 can be used to control a proportional hydraulic valve through a high-side output with PWM capability, and a low-side output with current sense.

*Note:* The CM0212 has Proportional-Integral-Derivative (PID) capabilities that make it possible to precisely control the current output for devices like proportional valves.

When making the connection, it is highly recommended to use the high-side and low-side outputs in pairs to avoid potential problems.

- The high-side output drive power to the valve coil and adjust the duty cycle of a PWM signal.
- The low-side output is used as a return path to ground for the valve coil and provides feedback on the amount of current flowing through the valve coil.

The CM0212 application code is written so that the PWM duty cycle for the output is adjusted to achieve a target current through the valve coil.

- If current feedback is lower than target, the PWM duty cycle should increase to boost average current through the valve coil.
- If the current feedback is higher than target, the PWM duty cycle should decrease to reduce average current through the valve coil.

The following shows how to connect a high-side and low-side output to control a proportional hydraulic valve:

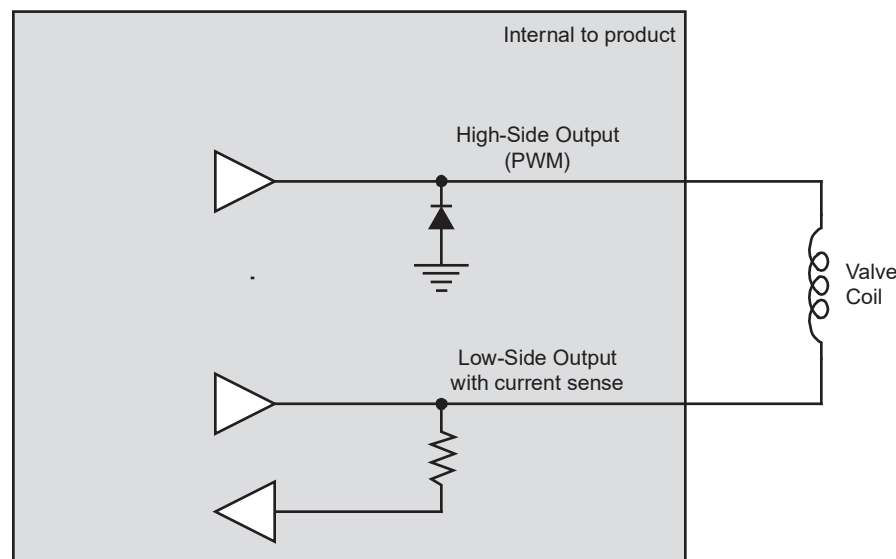


Figure: Connection for controlling a proportional valve

### 4.3. Connecting Various Sensors

There are many types of sensors that can be connected to the CM0212:

- Open emitter sensors
- Variable resistance sensors
- Variable reluctance sensors
- Switch sensors
  
- Voltage sensors
- CMOS sensors
- Potentiometer (ratiometric) sensors

*Note 1:* To optimize the reading accuracy for sensors, dedicate one of the main ground pins (called GND) as a low-current ground return for all sensors on the vehicle.

*Note 2:* When connecting sensors to the CM0212, use the sensor's specification to ensure that the CM0212 is configured correctly for the sensor.

### 4.4. Variable Resistance

Variable resistance sensors change impedance to represent its measured value and are compatible with analog inputs.

Variable resistance sensors are typically used in thermal and pressure applications. They work by changing the voltage reading on the sensor according to changes in pressure or temperature in the application.

The CM0212 cannot measure resistance directly.

To setup the CM0212 to measure resistance accurately, do the following:

- Include a precision pull-up resistor between the sensor and the sensor power output (called  $V_{\text{SENSOR}}$ ).
- Ensure the value of the precision resistor allows the maximum possible resolution for the sensor's input.
- Specify the precision resistor to get the maximum voltage range from the sensor.

*Note:* Variable resistance sensor accuracy may suffer at the extremes of the sensor's range. A tolerance analysis should be performed to ensure measurement accuracy is acceptable for your application.

The following shows a typical variable resistance sensor connection:

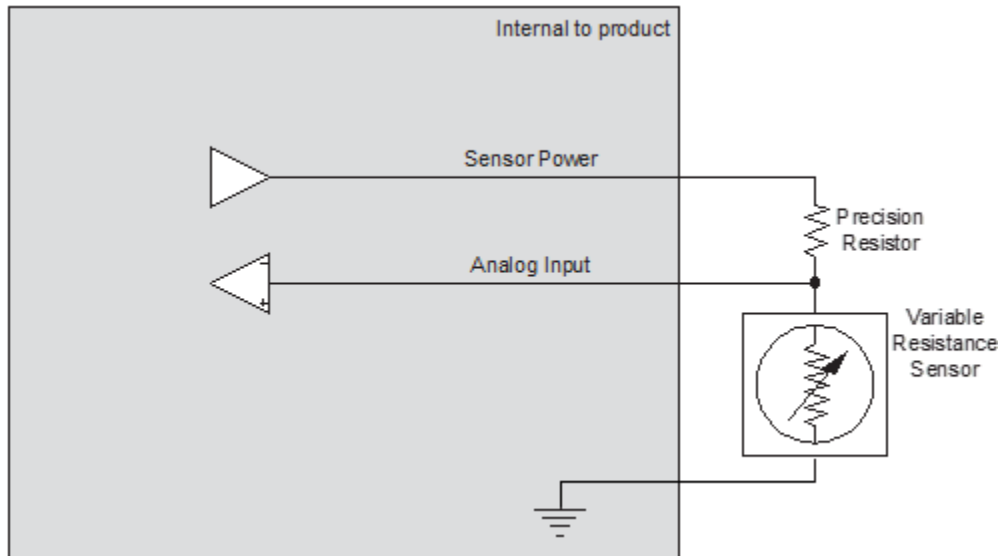


Figure2: Variable resistance sensor connection

## 4.5. Voltage

Voltage type sensors work by driving an analog voltage signal to report the sensor's measured value.

Voltage sensors are compatible with analog inputs and are typically used in applications that require variable voltage measurements.

The following shows a typical voltage sensor connection:

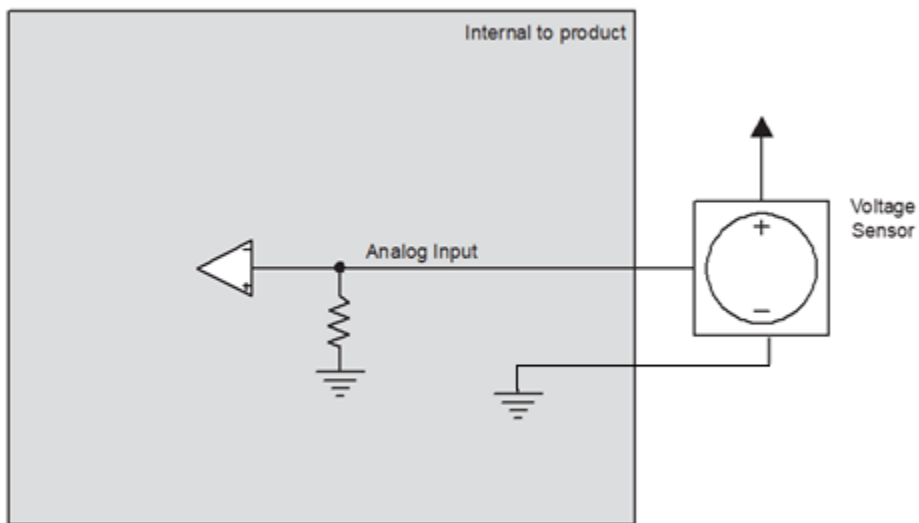


Figure3: Voltage sensor connection

## 4.6. Potentiometer (Ratiometric)

Potentiometers and other ratiometric type sensors can be wired directly to analog inputs.

Potentiometers are resistive devices that use a wiper arm to create a voltage divider. Changes to resistive measurements happen as the wiper arm moves along a resistive element.

When connecting potentiometer sensors, it is important to do the following:

- Connect one end of the sensor to the  $V_{SENSOR}$  pin, and the other end to a GND pin on the CM0212.
- Connect the sensor signal to an analog input.

The following shows a typical potentiometer sensor connection:

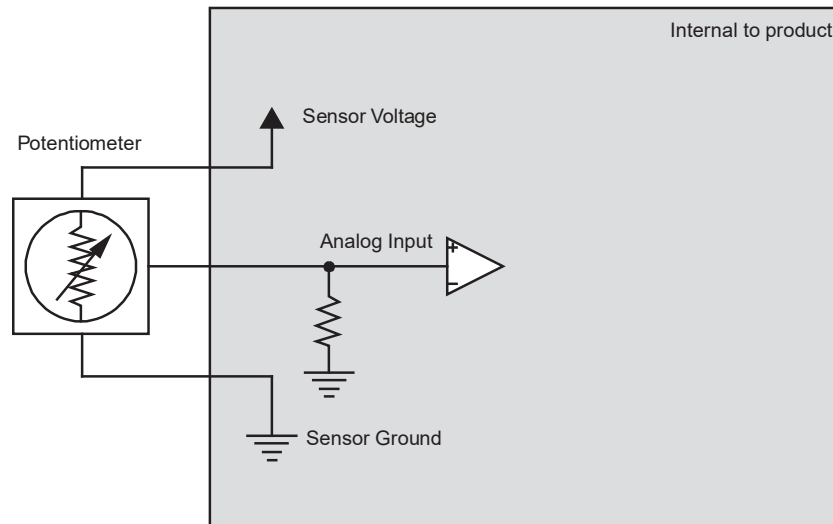


Figure: Potentiometer (ratiometric) sensor connection

## 5. CAN

This section describes the communication requirements for the machine controller.

### 5.1. CAN Source Address with Function Instance

The default Source Address of 228 is the value used upon first power up or EEPROM read issue.

The default Function Instance is 0 for Source Address 228, Source Address 229 is Function Instance 1, 230 is Function Instance 2, etc.

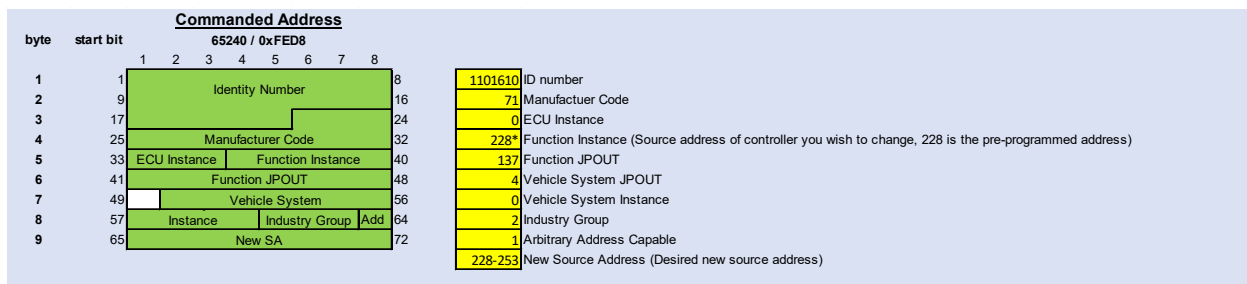
Address re-assignment will occur 50 ms after applying power to the CM0212. If the source address is equal to 254, the Function Instance is set to 30 and the controller waits for Source Address re-assignment within the valid range available (228 to 253).

During Source Address re-assignment, the Valves are disabled until success is determined.

The Source Address re-assignment is accomplished with:

PGN 65240 Commanded Address CA

### 5.2. CAN Commanded Address

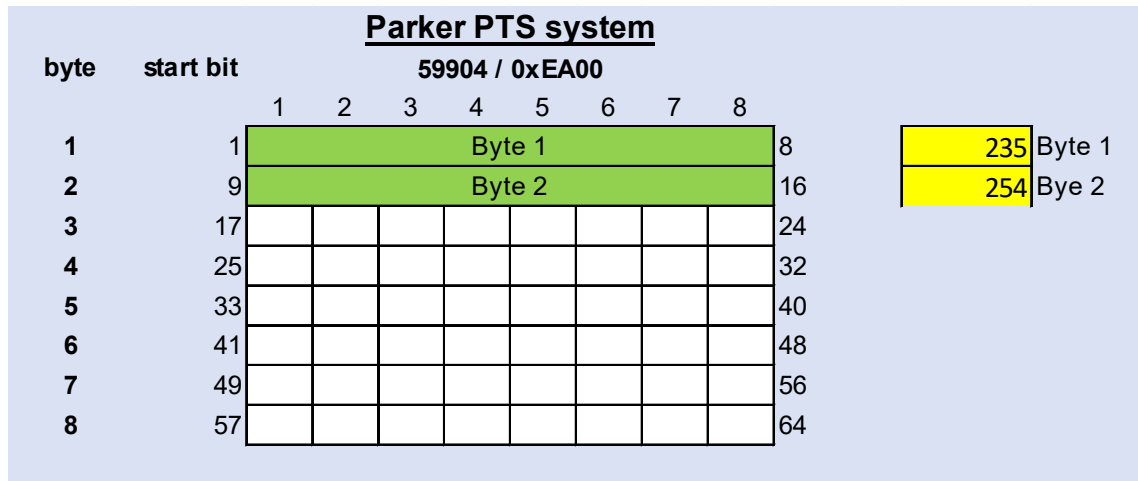


Commanded address is used to change the source address of the controller and follows the J1939 Commanded Address message.

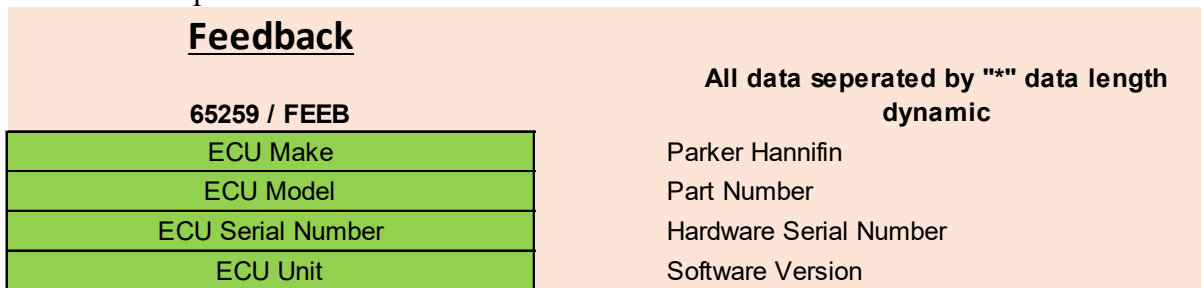
Default SA is 228 (i.e. 0xE4)

### 5.3. Parker PTS

Parker Hannifin utilizes the Component ID message to provide basic information about the controller and its software.



Controller Response:



## 6. Application/ Parameter Setting Examples

### 6.1. Common Application Settings

#### 6.1.1. General CAN Message Descriptions

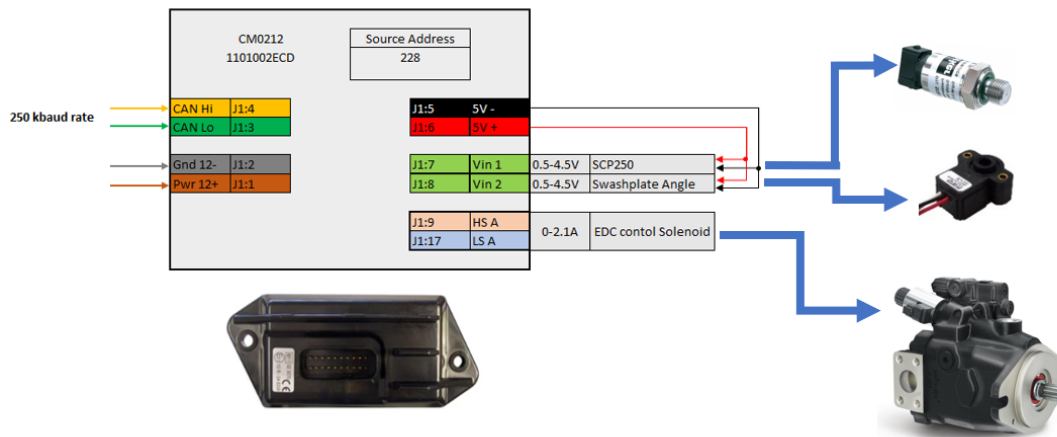
Active Commands	Messages that must be sent at least a 200 ms cycle time to command the outputs to the desired command. If the controller does not receive the active command message, the output will be disabled after 5 seconds.
Feedback	Messages broadcast by the controller to provide status of Inputs and Outputs.
Settings	Messages that must be sent to configure the controller for operation at least 1 time for initial configuration. All values are saved in non-volatile memory and will be stored through power cycles.

J1939 Message Types 1

#### 6.1.2. General Controller Settings

Current Control								Application Value	Description		
Byte	Start Bit	1	2	3	4	5	6	7	8		
		65470 / 0xFFBE									
1	1	Multiplex						8	228	Destination Module or (255) all modules	
2	9	Controller P						16	100	Closed Loop Current Control Gain	
3	17							24			
4	25	Controller I						32	100	Closed Loop Current Control Gain	
5	33							40			
6	41	Load Resistance ohms						48	20	Feed Forward based on coil resistance	
7	49	Standalone Mode						56	6	0 = All Other Configurations 6 = Dual Lever Control 7 = Dual Access Control	
8	57	Interlock Delay						64	5	Range is 0 – 50 0 - 5,000 milliseconds	

## 6.2. Pump Application



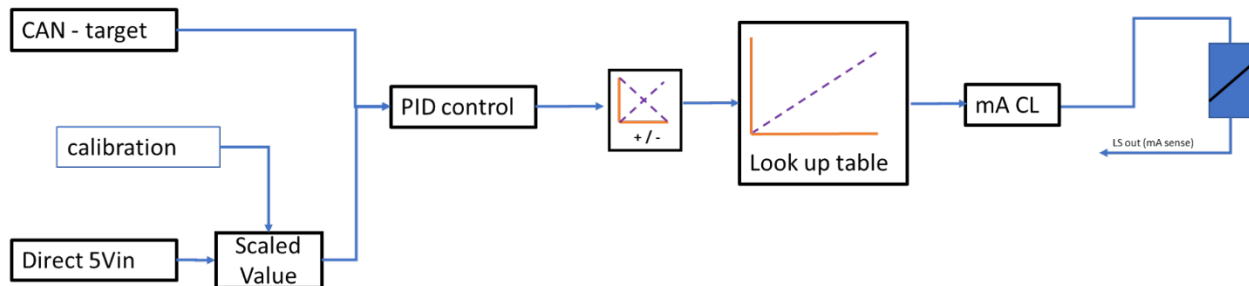
**Pump Control System Architecture 1**

Operating Modes:

Closed Loop Control (Pressure or Displacement)

Operating Mode: Auto (1) See PGN 65280 in the Active Command section

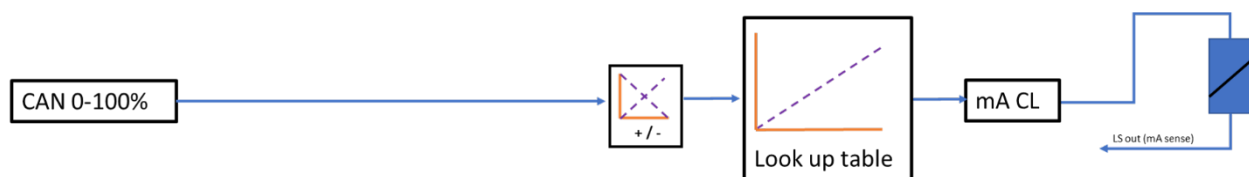
Auto Command: Target 0-1000 See PGN 65280 in the Active Command section



Open Loop CAN Direct Displacement Control

Operating Mode: Manual (2) See PGN 65280 in the Active Command section

Manual Command: 0-1000 See PGN 65280 in the Active Command section

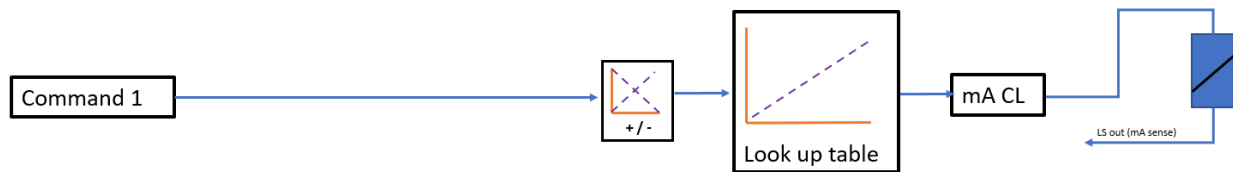


Discrete Command

Operating Mode: Command 1 (3) See PGN 65280 in the Active Command section

Command 1: 0-1000

See PGN 65280 in the Active Command section



### 6.2.1. Pump: Output 1

		Active Command 1								Description	
		1	2	3	4	5	6	7	8		
Byte	Start Bit	65280 / 0xFF00									
1	1	Multiplex								8	Destination Module or (255) all modules
2	9	Operating Mode								16	Discrete operating modes for command
3	17	Manual Mode Target								24	0-100.0% input into Output Command Logic
4	25									32	
5	33	Auto Mode Target								40	0-100.0% input into Output Closed Loop control as target
6	41									48	
7	49									56	
8	57								64		

## 6.2.2. Pump: Output 1 Settings

Settings A1									Application Value	Description		
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65282 / 0xFF02										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Auto Transition Delay								16	1000	Delay after switching to auto mode before engaging the auto mode ramp
3	17									24		
4	25	Max Frequency Hz								32	0	Max Frequency of a frequency sensor (not implemented)
5	33									40		
6	41	Command 2								48	1000	0-100.0% fixed command if for the Command 2 Operating Mode
7	49									56		
8	57								64			

Settings B1									Application Value	Description		
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65283 / 0xFF03										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	P term application								16	1	Application Gain for closed loop control
3	17									24		
4	25	I term application								32	1	Application Gain for closed loop control
5	33									40		
6	41	D term application								48	0	Application Gain for closed loop control
7	49									56		
8	57								64			

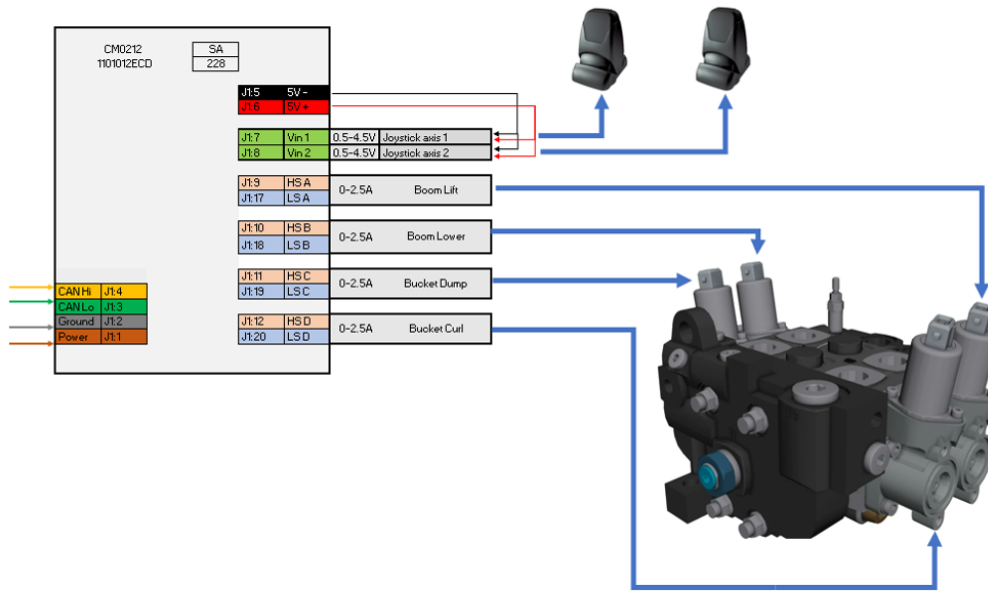
Settings C1								Application Value	Description			
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65284 / 0xFF04										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Auto Ramp								16	50	Rate of change limiter for auto mode, after auto mode ramp delay
3	17									24		
4	25	Command 1								32	100	0-100.0% fixed command if for the Command 1 Operating Mode
5	33									40		
6	41									48		
7	49									56		
8	57	Pos	Neg							64	0	Positive or negative invert control of output (fail to min, fail to max)

Settings D1								Application Value	Description			
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65285 / 0xFF05										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	GenOut Enable PWM								16	250	Enable / ON-OFF / PWM frequency of output
3	17	GenOut Min Current								24	0	Minimum current value for a ~0% command*
4	25									32		
5	33	GenOut Max Current								40	2100	Maximum current value for 100% command
6	41									48		
7	49	GenOut Ramp								56	1000	Rate of change limiter for all operating modes except Auto mode

Settings E1										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65286 / 0xFF06										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Point 1A								16	0	Input point to a lookup table
3	17	Point 2A								24	25	Input point to a lookup table
4	25	Point 3A								32	75	Input point to a lookup table
5	33	Point 4A								40	100	Input point to a lookup table
6	41									48		
7	49									56		
8	57									64		

Settings F1										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65287 / 0xFF07										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Point 1B								16	0	Output from lookup table
3	17	Point 2B								24	25	Output from lookup table
4	25	Point 3B								32	75	Output from lookup table
5	33	Point 4B								40	100	Output from lookup table
6	41									48		
7	49									56		
8	57									64		

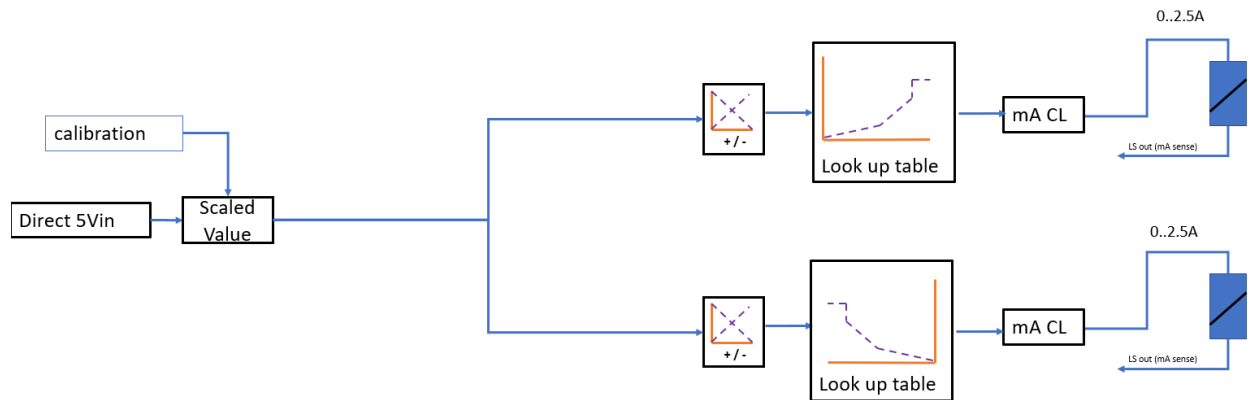
### 6.3. Two Section Bidirectional Valve Application



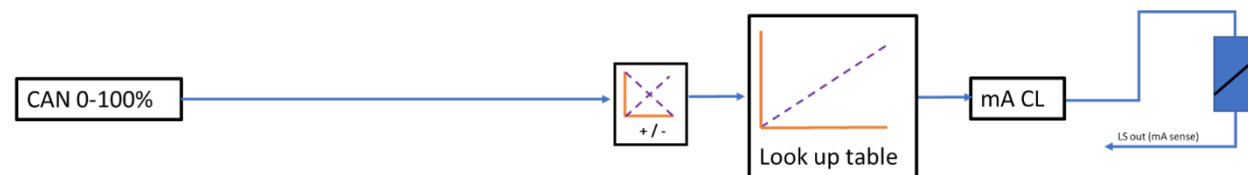
**Bidirectional Valve 1**

Operating Modes:

Direct input for bidirectional control.



CAN Based manual command for direct solenoid control.



### 6.3.1. Two Section Bidirectional Valve: Output 1

		Active Command 1								Description	
		1	2	3	4	5	6	7	8		
Byte	Start Bit	65280 / 0xFF00									
1	1	Multiplex								8	Destination Module or (255) all modules
2	9	Operating Mode								16	Discrete operating modes for command
3	17	Manual Mode Target								24	0-100.0% input into Output Command Logic
4	25									32	
5	33	Auto Mode Target								40	0-100.0% input into Output Closed Loop control as target
6	41									48	
7	49									56	
8	57									64	

### 6.3.2. Two Section Bidirectional Valve: Output 1 Settings

		Settings A1								Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65282 / 0xFF02										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Auto Transition Delay								16	1000	Delay after switching to auto mode before engaging the auto mode ramp
3	17									24		
4	25	Max Frequency Hz								32	0	Max Frequency of a frequency sensor (not implemented)
5	33									40		
6	41	Command 2								48	1000	0-100.0% fixed command if for the Command 2 Operating Mode
7	49									56		
8	57									64		

Settings B1										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65283 / 0xFF03										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	P Term Application								16	0	Application Gain for closed loop control
3	17									24		
4	25	I Term Application								32	0	Application Gain for closed loop control
5	33									40		
6	41	D Term Application								48	0	Application Gain for closed loop control
7	49									56		
8	57									64		

Settings C1										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65284 / 0xFF04										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Auto Ramp								16	0	Rate of change limiter for auto mode, after auto mode ramp delay
3	17									24		
4	25	Command 1								32	100	0-100.0% fixed command if for the Command 1 Operating Mode
5	33									40		
6	41									48		
7	49									56		
8	57	Pos	Neg							64	0	Positive or negative invert control of output (fail to min, fail to max)

Settings D1										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65285 / 0xFF05										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	GenOut Enable PWM								16	250	Enable / ON-OFF / PWM frequency of output
3	17	GenOut Min Current								24	0	Minimum current value for a ~0% command*
4	25									32		
5	33	GenOut Max Current								40	2100	Maximum current value for 100% command
6	41									48		
7	49	GenOut Ramp								56	0	Rate of change limiter for all operating modes except Auto mode
8	57									64		

Settings E1										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65286 / 0xFF06										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Point 1A								16	55	Input point to a lookup table
3	17	Point 2A								24	65	Input point to a lookup table
4	25	Point 3A								32	80	Input point to a lookup table
5	33	Point 4A								40	90	Input point to a lookup table
6	41									48		
7	49									56		
8	57									64		

Settings F1									Application Value	Description		
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65287 / 0xFF07										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Point 1B								16	0	Output from lookup table
3	17	Point 2B								24	20	Output from lookup table
4	25	Point 3B								32	50	Output from lookup table
5	33	Point 4B								40	100	Output from lookup table
6	41									48		
7	49									56		
8	57									64		

### 6.3.3. Two Section Bidirectional Valve: Output 2

Active Command 2									Description			
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65288 / 0xFF08										
1	1	Multiplex								8	Destination Module or (255) all modules	
2	9	Operating Mode									16	Discrete operating modes for command
3	17	Manual Mode Target								24	0-100.0% input into Output Command Logic	
4	25									32		
5	33	Auto Mode Target								40	0-100.0% input into Output Closed Loop control as target	
6	41									48		
7	49									56		
8	57									64		

### 6.3.4. Two Section Bidirectional Valve: Output 2 Settings

Settings A2								Application Value	Description			
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65290 / 0xFF0A										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Auto Transition Delay								16	1000	Delay after switching to auto mode before engaging the auto mode ramp
3	17									24		
4	25	Max Frequency Hz								32	0	Max Frequency of a frequency sensor (not implemented)
5	33									40		
6	41	Command 2								48	1000	0-100.0% fixed command if for the Command 2 Operating Mode
7	49									56		
8	57									64		

Settings B2								Application Value	Description			
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65291 / 0xFF0B										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	P Term Application								16	0	Application Gain for closed loop control
3	17									24		
4	25	I Term Application								32	0	Application Gain for closed loop control
5	33									40		
6	41	D Term Application								48	0	Application Gain for closed loop control
7	49									56		
8	57									64		

Settings C2								Application Value	Description								
								1	2	3	4	5	6	7	8		
Byte	Start Bit	65292 / 0xFF0C															
1	1	Multiplex								8	228	Destination Module or (255) all modules					
2	9	Auto Ramp								16	0	Rate of change limiter for auto mode, after auto mode ramp delay					
3	17									24							
4	25	Command 1								32	100	0-100.0% fixed command if for the Command 1 Operating Mode					
5	33									40							
6	41									48							
7	49									56							
8	57	Pos Neg								64	0	Positive or negative invert control of output (fail to min, fail to max)					

Settings D2								Application Value	Description								
								1	2	3	4	5	6	7	8		
Byte	Start Bit	65293 / 0xFF0D															
1	1	Multiplex								8	228	Destination Module or (255) all modules					
2	9	GenOut Enable PWM								16	250	Enable / ON-OFF / PWM frequency of output					
3	17	GenOut Min Current								24	0	Minimum current value for a ~0% command*					
4	25									32							
5	33	GenOut Max Current								40	2100	Maximum current value for 100% command					
6	41									48							
7	49	GenOut Ramp								56	0	Rate of change limiter for all operating modes except Auto mode					
8	57									64							

Settings E2										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65294 / 0xFF0E										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Point 1A								16	10	Input point to a lookup table
3	17	Point 2A								24	20	Input point to a lookup table
4	25	Point 3A								32	35	Input point to a lookup table
5	33	Point 4A								40	45	Input point to a lookup table
6	41									48		
7	49									56		
8	57									64		

Settings F2										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65295 / 0xFF0F										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Point 1B								16	100	Output from lookup table
3	17	Point 2B								24	50	Output from lookup table
4	25	Point 3B								32	20	Output from lookup table
5	33	Point 4B								40	0	Output from lookup table
6	41									48		
7	49									56		
8	57									64		

### 6.3.5. Two Section Bidirectional Valve: Output 3

Active Command 3								Description				
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65296 / 0xFF10										
1	1	Multiplex						8	Destination Module or (255) all modules			
2	9	Operating Mode								16	Discrete operating modes for command	
3	17	Manual Mode Target						24	0-100.0% input into Output Command Logic			
4	25							32				
5	33	Auto Mode Target						40	0-100.0% input into Output Closed Loop control as target			
6	41							48				
7	49									56		
8	57									64		

### 6.3.6. Two Section Bidirectional Valve: Output 3 Settings

Settings A3								Application Value	Description			
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65298 / 0xFF12										
1	1	Multiplex						8	228	Destination Module or (255) all modules		
2	9	Auto Transition Delay						16	1000	Delay after switching to auto mode before engaging the auto mode ramp		
3	17							24				
4	25	Max Frequency Hz						32	0	Max Frequency of a frequency sensor (not implemented)		
5	33							40				
6	41	Command 2						48	1000	0-100.0% fixed command if for the Command 2 Operating Mode		
7	49							56				
8	57									64		

Settings B3										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65299 / 0xFF13										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	P Term Application								16	0	Application Gain for closed loop control
3	17									24		
4	25	I Term Application								32	0	Application Gain for closed loop control
5	33									40		
6	41	D Term Application								48	0	Application Gain for closed loop control
7	49									56		
8	57									64		

Settings C3										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65300 / 0xFF14										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Auto Ramp								16	0	Rate of change limiter for auto mode, after auto mode ramp delay
3	17									24		
4	25	Command 1								32	100	0-100.0% fixed command if for the Command 1 Operating Mode
5	33									40		
6	41									48		
7	49									56		
8	57	Pos Neg								64	0	Positive or negative invert control of output (fail to min, fail to max)

Settings D3										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65301 / 0xFF15										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	GenOut Enable PWM								16	250	Enable / ON-OFF / PWM frequency of output
3	17	GenOut Min Current								24	0	Minimum current value for a ~0% command*
4	25									32		
5	33	GenOut Max Current								40	2100	Maximum current value for 100% command
6	41									48		
7	49	GenOut Ramp								56	0	Rate of change limiter for all operating modes except Auto mode
8	57									64		

Settings E3										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65302 / 0xFF16										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Point 1A								16	55	Input point to a lookup table
3	17	Point 2A								24	65	Input point to a lookup table
4	25	Point 3A								32	80	Input point to a lookup table
5	33	Point 4A								40	90	Input point to a lookup table
6	41									48		
7	49									56		
8	57									64		

Settings F3									Application Value	Description		
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65303 / 0xFF17										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Point 1B								16	0	Output from lookup table
3	17	Point 2B								24	20	Output from lookup table
4	25	Point 3B								32	50	Output from lookup table
5	33	Point 4B								40	100	Output from lookup table
6	41									48		
7	49									56		
8	57									64		

### 6.3.7. Two Section Bidirectional Valve: Output 4

Active Command 4									Description			
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65304 / 0xFF18										
1	1	Multiplex								8	Destination Module or (255) all modules	
2	9	Operating Mode								16	Discrete operating modes for command	
3	17	Manual Mode Target								24	0-100.0% input into Output Command Logic	
4	25									32		
5	33	Auto Mode Target								40	0-100.0% input into Output Closed Loop control as target	
6	41									48		
7	49									56		
8	57									64		

### 6.3.8. Two Section Bidirectional Valve: Output 4 Settings

Settings A4										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65306 / 0xFF1A										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Auto Transition Delay								16	1000	Delay after switching to auto mode before engaging the auto mode ramp
3	17									24		
4	25	Max Frequency Hz								32	0	Max Frequency of a frequency sensor (not implemented)
5	33									40		
6	41	Command 2								48	1000	0-100.0% fixed command if for the Command 2 Operating Mode
7	49									56		
8	57									64		

Settings B4										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65307 / 0xFF1B										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	P Term Application								16	0	Application Gain for closed loop control
3	17									24		
4	25	I Term Application								32	0	Application Gain for closed loop control
5	33									40		
6	41	D Term Application								48	0	Application Gain for closed loop control
7	49									56		
8	57									64		

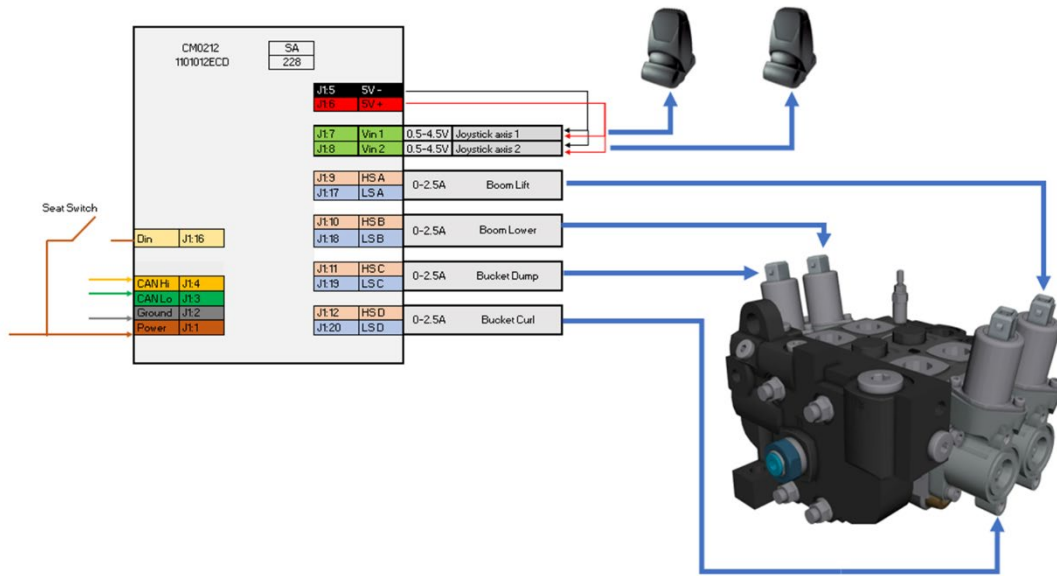
Settings C4								Application Value	Description			
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65308 / 0xFF1C										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Auto Ramp								16	0	Rate of change limiter for auto mode, after auto mode ramp delay
3	17									24		
4	25	Command 1								32	100	0-100.0% fixed command if for the Command 1 Operating Mode
5	33									40		
6	41									48		
7	49									56		
8	57	Pos Neg								64	0	Positive or negative invert control of output (fail to min, fail to max)

Settings D4								Application Value	Description			
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65309 / 0xFF1D										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	GenOut Enable PWM								16	250	Enable / ON-OFF / PWM frequency of output
3	17	GenOut Min Current								24	0	Minimum current value for a ~0% command*
4	25									32		
5	33	GenOut Max Current								40	2100	Maximum current value for 100% command
6	41									48		
7	49	GenOut Ramp								56	0	Rate of change limiter for all operating modes except Auto mode
8	57									64		

Settings E4										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65310 / 0xFF1E										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Point 1A								16	10	Input point to a lookup table
3	17	Point 2A								24	20	Input point to a lookup table
4	25	Point 3A								32	35	Input point to a lookup table
5	33	Point 4A								40	45	Input point to a lookup table
6	41									48		
7	49									56		
8	57									64		

Settings F4										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65311 / 0xFF1F										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Point 1B								16	100	Output from lookup table
3	17	Point 2B								24	50	Output from lookup table
4	25	Point 3B								32	20	Output from lookup table
5	33	Point 4B								40	0	Output from lookup table
6	41									48		
7	49									56		
8	57									64		

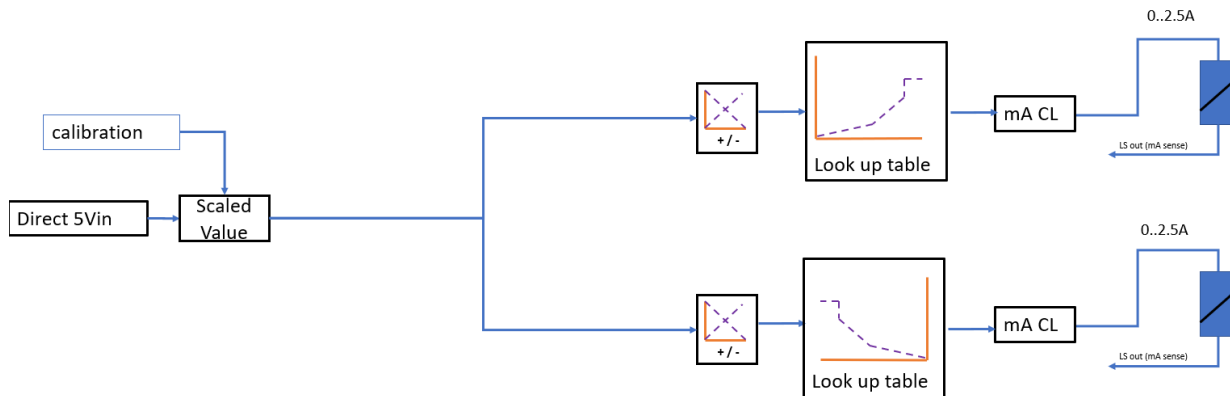
## 6.4. Standalone Valve Application



Operating Modes:

Direct input for bidirectional control.

Note: PIN16 interlock must be active to allow operation.



## 6.4.1. Standalone Valve: Output 1 Settings

Settings A1								Application Value	Description		
		1	2	3	4	5	6	7	8		
Byte	Start Bit	65282 / 0xFF02									
1	1	Multiplex						8	228	Destination Module or (255) all modules	
2	9	Auto Transition Delay						16	1000	Delay after switching to auto mode before engaging the auto mode ramp	
3	17							24			
4	25	Max Frequency Hz						32	0	Max Frequency of a frequency sensor (not implemented)	
5	33							40			
6	41	Command 2						48	1000	0-100.0% fixed command if for the Command 2 Operating Mode	
7	49							56			
8	57							64			

Settings B1								Application Value	Description		
		1	2	3	4	5	6	7	8		
Byte	Start Bit	65283 / 0xFF03									
1	1	Multiplex						8	228	Destination Module or (255) all modules	
2	9	P Term Application						16	0	Application Gain for closed loop control	
3	17							24			
4	25	I Term Application						32	0	Application Gain for closed loop control	
5	33							40			
6	41	D Term Application						48	0	Application Gain for closed loop control	
7	49							56			
8	57							64			

Settings C1								Application Value	Description			
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65284 / 0xFF04										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Auto Ramp								16	0	Rate of change limiter for auto mode, after auto mode ramp delay
3	17									24		
4	25	Command 1								32	100	0-100.0% fixed command if for the Command 1 Operating Mode
5	33									40		
6	41									48		
7	49									56		
8	57	Pos	Neg							64	0	Positive or negative invert control of output (fail to min, fail to max)

Settings D1								Application Value	Description			
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65285 / 0xFF05										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	GenOut Enable PWM								16	250	Enable / ON-OFF / PWM frequency of output
3	17	GenOut Min Current								24	0	Minimum current value for a ~0% command*
4	25									32		
5	33	GenOut Max Current								40	2100	Maximum current value for 100% command
6	41									48		
7	49	GenOut Ramp								56	0	Rate of change limiter for all operating modes except Auto mode
8	57									64		

Settings E1										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65286 / 0xFF06										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Point 1A								16	55	Input point to a lookup table
3	17	Point 2A								24	65	Input point to a lookup table
4	25	Point 3A								32	80	Input point to a lookup table
5	33	Point 4A								40	90	Input point to a lookup table
6	41									48		
7	49									56		
8	57									64		

Settings F1										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65287 / 0xFF07										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Point 1B								16	0	Output from lookup table
3	17	Point 2B								24	20	Output from lookup table
4	25	Point 3B								32	50	Output from lookup table
5	33	Point 4B								40	100	Output from lookup table
6	41									48		
7	49									56		
8	57									64		

## 6.4.2. Standalone Valve: Output 2 Settings

Settings A2								Application Value	Description			
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65290 / 0xFF0A										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Auto Transition Delay								16	1000	Delay after switching to auto mode before engaging the auto mode ramp
3	17									24		
4	25	Max Frequency Hz								32	0	Max Frequency of a frequency sensor (not implemented)
5	33									40		
6	41	Command 2								48	1000	0-100.0% fixed command if for the Command 2 Operating Mode
7	49									56		
8	57									64		

Settings B2								Application Value	Description			
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65291 / 0xFF0B										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	P Term Application								16	0	Application Gain for closed loop control
3	17									24		
4	25	I Term Application								32	0	Application Gain for closed loop control
5	33									40		
6	41	D Term Application								48	0	Application Gain for closed loop control
7	49									56		
8	57									64		

Settings C2								Application Value	Description								
								1	2	3	4	5	6	7	8		
Byte	Start Bit	65292 / 0xFF0C															
1	1	Multiplex								8	228	Destination Module or (255) all modules					
2	9	Auto Ramp								16	0	Rate of change limiter for auto mode, after auto mode ramp delay					
3	17									24							
4	25	Command 1								32	100	0-100.0% fixed command if for the Command 1 Operating Mode					
5	33									40							
6	41								48								
7	49								56								
8	57	Pos	Neg						64	0	Positive or negative invert control of output (fail to min, fail to max)						

Settings D2								Application Value	Description								
								1	2	3	4	5	6	7	8		
Byte	Start Bit	65293 / 0xFF0D															
1	1	Multiplex								8	228	Destination Module or (255) all modules					
2	9	GenOut Enable PWM								16	250	Enable / ON-OFF / PWM frequency of output					
3	17	GenOut Min Current								24	0	Minimum current value for a ~0% command*					
4	25									32							
5	33	GenOut Max Current								40	2100	Maximum current value for 100% command					
6	41									48							
7	49	GenOut Ramp								56	0	Rate of change limiter for all operating modes except Auto mode					
8	57									64							

Settings E2										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65294 / 0xFF0E										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Point 1A								16	10	Input point to a lookup table
3	17	Point 2A								24	20	Input point to a lookup table
4	25	Point 3A								32	35	Input point to a lookup table
5	33	Point 4A								40	45	Input point to a lookup table
6	41									48		
7	49									56		
8	57									64		

Settings F2										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65295 / 0xFF0F										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Point 1B								16	100	Output from lookup table
3	17	Point 2B								24	50	Output from lookup table
4	25	Point 3B								32	20	Output from lookup table
5	33	Point 4B								40	0	Output from lookup table
6	41									48		
7	49									56		
8	57									64		

### 6.4.3. Standalone Valve: Output 3 Settings

Settings A3								Application Value	Description			
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65298 / 0xFF12										
1	1	Multiplex						8	228	Destination Module or (255) all modules		
2	9	Auto Transition Delay						16	1000	Delay after switching to auto mode before engaging the auto mode ramp		
3	17							24				
4	25	Max Frequency Hz						32	0	Max Frequency of a frequency sensor (not implemented)		
5	33							40				
6	41	Command 2						48	1000	0-100.0% fixed command if for the Command 2 Operating Mode		
7	49							56				
8	57								64			

Settings B3								Application Value	Description			
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65299 / 0xFF13										
1	1	Multiplex						8	228	Destination Module or (255) all modules		
2	9	P Term Application						16	0	Application Gain for closed loop control		
3	17							24				
4	25	I Term Application						32	0	Application Gain for closed loop control		
5	33							40				
6	41	D Term Application						48	0	Application Gain for closed loop control		
7	49							56				
8	57								64			

Settings C3								Application Value	Description								
								1	2	3	4	5	6	7	8		
Byte	Start Bit	65300 / 0xFF14															
1	1	Multiplex								8	228	Destination Module or (255) all modules					
2	9	Auto Ramp								16	0	Rate of change limiter for auto mode, after auto mode ramp delay					
3	17									24							
4	25	Command 1								32	100	0-100.0% fixed command if for the Command 1 Operating Mode					
5	33									40							
6	41									48							
7	49									56							
8	57	Pos	Neg							64	0	Positive or negative invert control of output (fail to min, fail to max)					

Settings D3								Application Value	Description								
								1	2	3	4	5	6	7	8		
Byte	Start Bit	65301 / 0xFF15															
1	1	Multiplex								8	228	Destination Module or (255) all modules					
2	9	GenOut Enable PWM								16	250	Enable / ON-OFF / PWM frequency of output					
3	17	GenOut Min Current								24	0	Minimum current value for a ~0% command*					
4	25									32							
5	33	GenOut Max Current								40	2100	Maximum current value for 100% command					
6	41									48							
7	49	GenOut Ramp								56	0	Rate of change limiter for all operating modes except Auto mode					
8	57									64							

Settings E3										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65302 / 0xFF16										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Point 1A								16	55	Input point to a lookup table
3	17	Point 2A								24	65	Input point to a lookup table
4	25	Point 3A								32	80	Input point to a lookup table
5	33	Point 4A								40	90	Input point to a lookup table
6	41									48		
7	49									56		
8	57									64		

Settings F3										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65303 / 0xFF17										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Point 1B								16	0	Output from lookup table
3	17	Point 2B								24	20	Output from lookup table
4	25	Point 3B								32	50	Output from lookup table
5	33	Point 4B								40	100	Output from lookup table
6	41									48		
7	49									56		
8	57									64		

## 6.4.4. Standalone Valve: Output 4 Settings

Settings A4									Application Value	Description		
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65306 / 0xFF1A										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Auto Transition Delay								16	1000	Delay after switching to auto mode before engaging the auto mode ramp
3	17									24		
4	25	Max Frequency Hz								32	0	Max Frequency of a frequency sensor (not implemented)
5	33									40		
6	41	Command 2								48	1000	0-100.0% fixed command if for the Command 2 Operating Mode
7	49									56		
8	57								64			

Settings B4									Application Value	Description		
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65307 / 0xFF1B										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	P Term Application								16	0	Application Gain for closed loop control
3	17									24		
4	25	I Term Application								32	0	Application Gain for closed loop control
5	33									40		
6	41	D Term Application								48	0	Application Gain for closed loop control
7	49									56		
8	57								64			

Settings C4								Application Value	Description								
								1	2	3	4	5	6	7	8		
Byte	Start Bit	65308 / 0xFF1C															
1	1	Multiplex								8	228	Destination Module or (255) all modules					
2	9	Auto Ramp								16	0	Rate of change limiter for auto mode, after auto mode ramp delay					
3	17									24							
4	25	Command 1								32	100	0-100.0% fixed command if for the Command 1 Operating Mode					
5	33									40							
6	41								48								
7	49								56								
8	57	Pos	Neg						64	0	Positive or negative invert control of output (fail to min, fail to max)						

Settings D4								Application Value	Description								
								1	2	3	4	5	6	7	8		
Byte	Start Bit	65309 / 0xFF1D															
1	1	Multiplex								8	228	Destination Module or (255) all modules					
2	9	GenOut Enable PWM								16	250	Enable / ON-OFF / PWM frequency of output					
3	17	GenOut Min Current								24	0	Minimum current value for a ~0% command*					
4	25									32							
5	33	GenOut Max Current								40	2100	Maximum current value for 100% command					
6	41									48							
7	49	GenOut Ramp								56	0	Rate of change limiter for all operating modes except Auto mode					
8	57									64							

Settings E4										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65310 / 0xFF1E										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Point 1A								16	10	Input point to a lookup table
3	17	Point 2A								24	20	Input point to a lookup table
4	25	Point 3A								32	35	Input point to a lookup table
5	33	Point 4A								40	45	Input point to a lookup table
6	41									48		
7	49									56		
8	57									64		

Settings F4										Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65311 / 0xFF1F										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Point 1B								16	100	Output from lookup table
3	17	Point 2B								24	50	Output from lookup table
4	25	Point 3B								32	20	Output from lookup table
5	33	Point 4B								40	0	Output from lookup table
6	41									48		
7	49									56		
8	57									64		

Current Control								Application Value	Description								
								1	2	3	4	5	6	7	8		
Byte	Start Bit	65470 / 0xFFBE															
1	1	Multiplex								8	228	Destination Module or (255) all modules					
2	9	Controller P								16	100	Closed Loop Current Control Gain					
3	17									24							
4	25	Controller I								32	100	Closed Loop Current Control Gain					
5	33									40							
6	41	Load Resistance ohms								48	20	Feed Forward based on coil resistance					
7	49									56							
8	57									64							

Calibration								Application Value	Description								
								1	2	3	4	5	6	7	8		
Byte	Start Bit	65281 (Optional) / 0xFF01															
1	1	Multiplex								8	228	Destination Module or (255) all modules					
2	9	Cal CMD								16	1	Command to memorize single point calibration					
3	17	Calibration Min mV								24	0	Sensor must be above this point to allow calibration					
4	25									32							
5	33	Calibration Max mV								40	1000	Sensor must be above this point to allow calibration					
6	41									48							
7	49	Sensor Range mV								56	4000	Total range of sensor to determine max mV = 100%					
8	57									64							

## 6.5. Feedback & Calibration

### 6.5.1. General Controller Feedback Messages

This is the common feedback for all applications inputs, outputs and error states. Provides status at all times regardless of application, through 5Hz broadcast feeds.

Controller Status 1										Description
		1	2	3	4	5	6	7	8	
Byte	Start Bit	65380 / 0xFF64								
1	1	Out 1	Out 2	Out 3	Out 4			8	Output Status	
2	9	Out 5	Out 6	Out 7	Out 8			16	Output Status	
3	17	Input 1						24	Input feedback mV	
4	25							32		
5	33	Hz 1						40	Input feedback Hz	
6	41							48		
7	49	Input 2						56	Input feedback mV	
8	57							64		

Controller Status 2										Description
		1	2	3	4	5	6	7	8	
Byte	Start Bit	65381 / 0xFF65								
1	1	Out 1 mA						8	Output 1 mA	
2	9							16		
3	17	Out 2 mA						24	Output 2 mA	
4	25							32		
5	33	Out 3 mA						40	Output 3 mA	
6	41							48		
7	49	Out 4 mA						56	Output 4 mA	
8	57							64		

Controller Status 3										Description		
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65382 / 0xFF66										
1	1	Out 5%								8	Output 5% PWM	
2	9	Out 6%								16	Output 6% PWM	
3	17	Out 7%								24	Output 7% PWM	
4	25	Out 8%								32	Output 8% PWM	
5	33											
6	41											
7	49	Module Voltage								56	Measured voltage level at module	
8	57									64		

Controller Status 4										Description		
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65383 / 0xFF67										
1	1	Input 1 Calibration								8	Memorized value of calibration for sensor	
2	9									16		
3	17	Input 1 Range								24	Range of sensor (value added to memorized value to determine 100% sensor value)	
4	25									32		
5	33	Input 2 Calibration								40	Memorized value of calibration for sensor	
6	41									48		
7	49	Input 2 Range								56	Range of sensor (value added to memorized value to determine 100% sensor value)	
8	57									64		

## 6.5.2. General Input Calibration Settings

		Calibration								Application Value	Description	
		1	2	3	4	5	6	7	8			
Byte	Start Bit	65281 (Optional) / 0xFF01										
1	1	Multiplex								8	228	Destination Module or (255) all modules
2	9	Cal								16	1	Command to memorize single point calibration
3	17	Calibration Min mV								24	0	Sensor must be above this point to allow calibration
4	25									32		
5	33	Calibration Max mV								40	1000	Sensor must be below this point to allow calibration
6	41									48		
7	49	Sensor Range mV								56	4000	Total range of sensor to determine max mV = 100%
8	57									64		