IQ-SBLOCK

1000000768 User Guide

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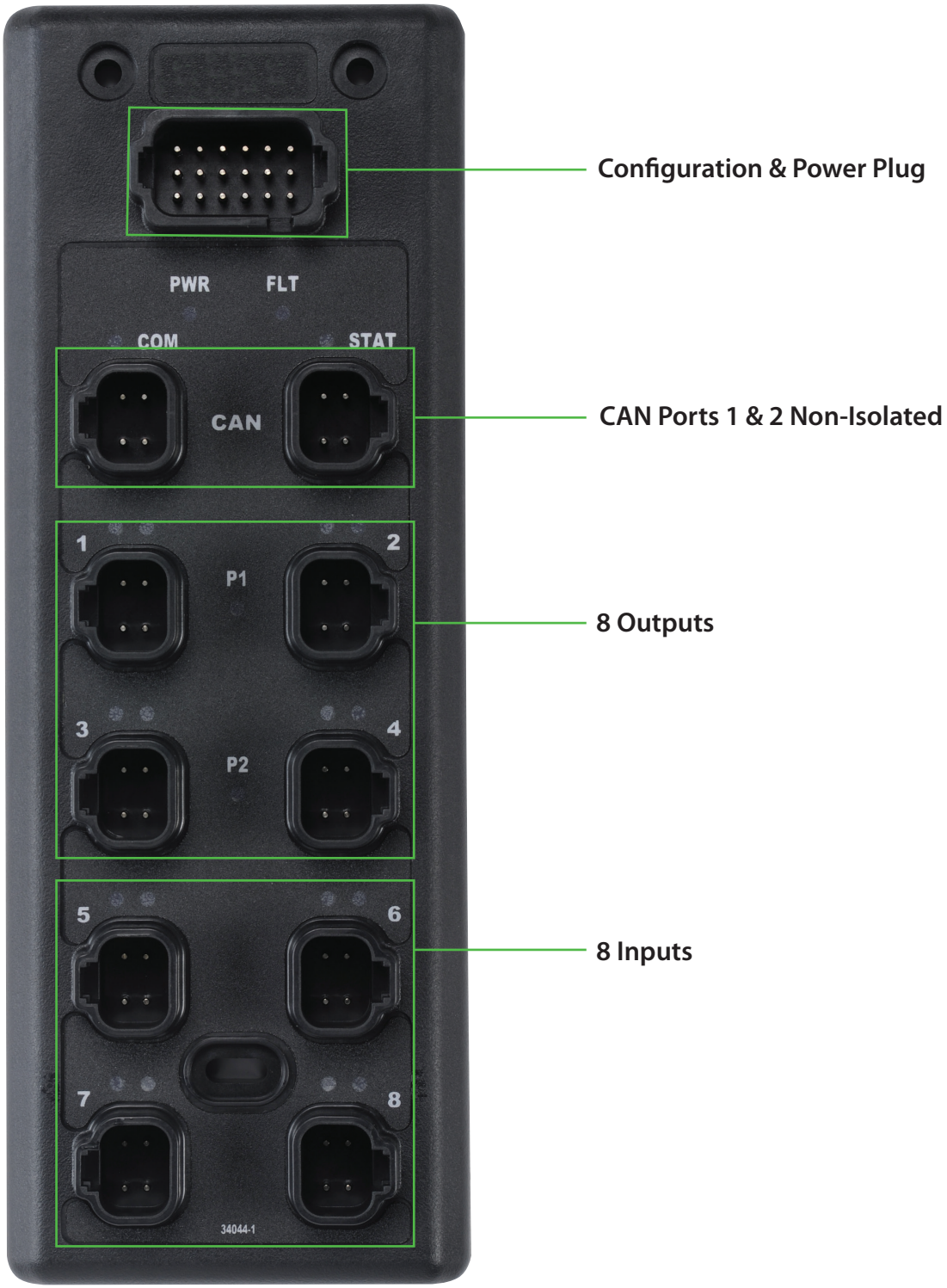
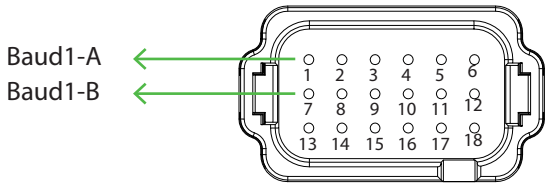
| MODULE OVERVIEW



| CONFIGURING THE BAUD RATE

Configuration of the baud rate is done using pins 1 & 7 of the Power and Configuration plug shown below. Currently there are 2 baud rates supported, 250kb and 500kb. If you are connecting to a 250kb network no jumpers are required. If connecting to a 500kb network, jumper pin 1 to pin 7.

Configuration & Power Plug



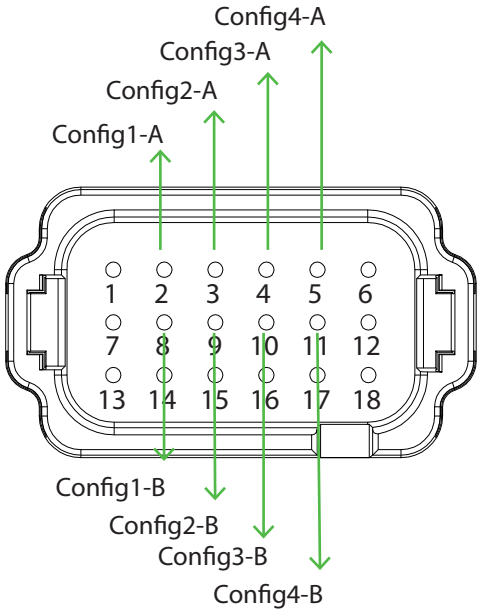
Baud Rate
No Jumper = 250kb
Baud1-A to Baud1-B = 500kb

Please note that all devices on the same J1939 network must have the same baud rate

All unused pins need to be plugged with a Deutsch #114017 sealing plug to maintain the IP67 rating

| CONFIGURING THE NODE ID

The Node ID is configured by jumpering the matching Config-A to Config-B. The Node ID starts with a base source address of **61408** (0xEFE0) with no jumpers installed. The offset address is configured with the use of binary coded decimal (BCD). A power cycle is required when changing the Node ID. If a duplicate source address is on the network on a power up our module will stay in address arbitration mode and will not function.



Node ID (0-15 Offset) in BCD

Config1-A (pin 2) to Config1-B (pin 8) = 1's
Config2-A (pin 3) to Config2-B (pin 9) = 2's
Config3-A (pin 4) to Config3-B (pin 10) = 4's
Config4-A (pin 5) to Config4-B (pin 11) = 8's

Node ID	1's	2's	4's	8's	Node ID
0	0	0	0	0	**61408**
1	1	0	0	0	**61409**
2	0	1	0	0	**61410**
3	1	1	0	0	**61411**
4	0	0	1	0	**61412**
5	1	0	1	0	**61413**
6	0	1	1	0	**61414**
7	1	1	1	0	**61415**
8	0	0	0	1	**61416**
9	1	0	0	1	**61417**
10	0	1	0	1	**61418**
11	1	1	0	1	**61419**
12	0	0	1	1	**61420**
13	1	0	1	1	**61421**
14	0	1	1	1	**61422**
15	1	1	1	1	**61423**

|EXAMPLE

Jumpers from pin 2 to pin 8 (1's) and pin 4 to pin 10 (4's)
offset= 1+4=5
61408 (base address) + 5 (Node ID) = 61413 (Node ID))

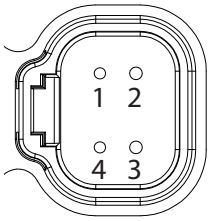
Please note that all devices on the same J1939 network must have a different Node ID

All unused pins need to be plugged with a Deutsch #114017 sealing plug to maintain the IP67 rating

| POWERING THE MODULE

The module recieves its power from the CAN ports. The module power is limited to 13 amps and is used to power connected modules down the line. This power is also used for all input ports as well.

CAN Ports 1 & 2 Non-Isolated



CAN	Power
(J1939)	
Pin 2 = CAN High	Pin 1 = 8-32V DC
Pin 4 = CAN Low	Pin 3 = Ground A

Please note that module power should NOT be used to power any output devices.

The first and last Node on the network must have a 120 Ohm terminating resistor.

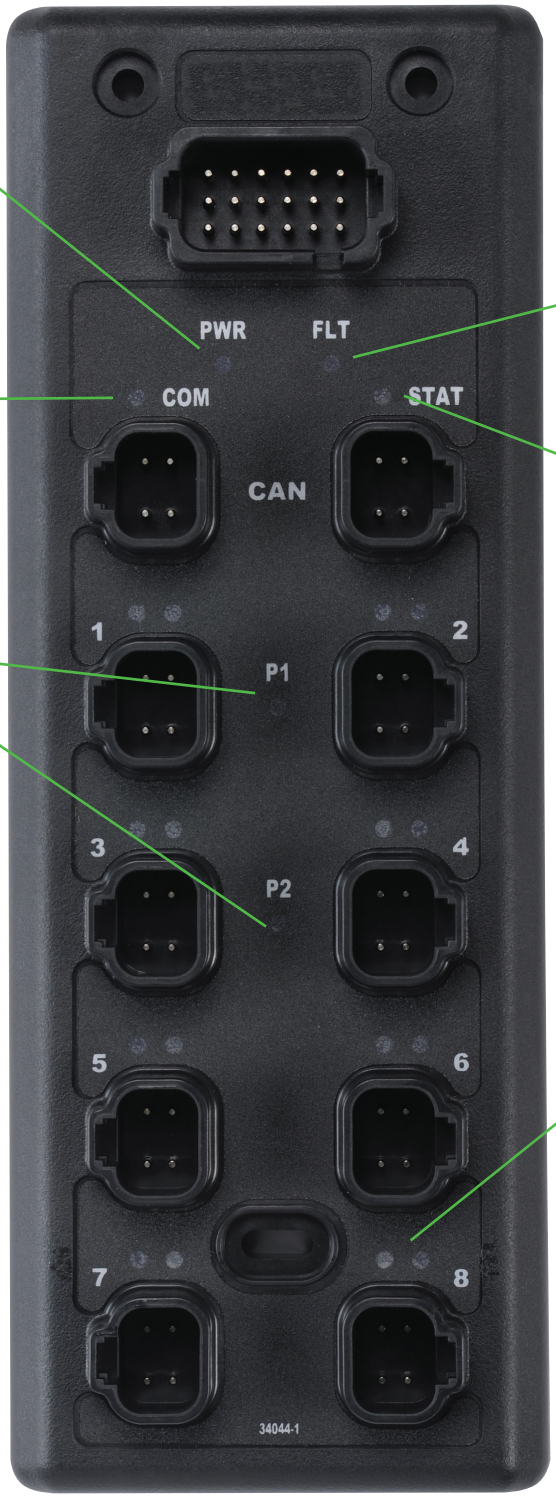
| LEDs

During start up the LEDs will come on for 3-5 seconds to verify that they are working (bulb test).

PWR LED - Blue
Indicates module power is connected

COM LED - Green
Communication Status

Buss Power - Blue
P1 = Power for ports 1 & 2
P2 = Power for ports 3 & 4



FLT LED - Red
Fault Status

STAT LED - Green
Module Status

PORT I/O LED - Yellow
Left LED = Output A
Right LED = Output B

Status
1. Steady On = Output/Input is on
2. Flashing On (Output Port)= Output has a fault
3. Flashing On (Input Port)= Input is pulsing

| LED STATUS

COM LED - Green

Communication Status

ID	COM Fault Description	ON	OFF
n/a	Bootload Mode	Indicates traffic on bus	N/A
C0	Valid Communication Network	ON	
C1	Source Address (SA) Arbitration	1 Short	1 Long
C2	CANBUS Hardware Fault	2 Short	
C3	Output Control Message Missing	3 Short	
C4	DM13 Detected*	4 Short	

* See J1939-73 diagnostics, another device has requested module to stop broadcasting

FLT LED - Red

Fault Status

ID	Fault Description	ON	OFF
F0	Bootload Mode	1 Short	1 Short
F1	Output Over Current Fault	1 Short	1 Long
F2	Low Voltage Warning	2 Short	
F3	Over Voltage Warning	3 Short	
F4	Over Temperature Warning	4 Short	
F5	EEPROM Fault	5 Short	

For 12V DC system, over voltage is defined as input voltage > 18V DC, low voltage is defined as < 11V DC.
For 24V DC system, over voltage is defined as input voltage > 32V DC, low voltage is defined as < 20V DC.

STAT LED - Green

ID	Fault Description	ON	OFF
S0	USB Connected (Reserved)	ON	
S1	DP Logic Configuration Disabled	1 Short	1 Long
S2	DP Logic Mismatch	2 Short	

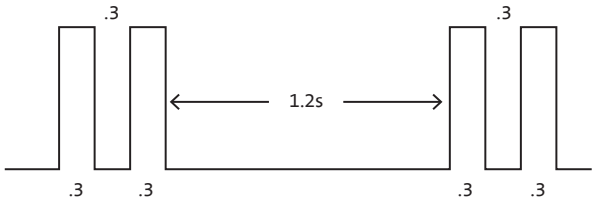
PORT I/O LED - Yellow

Left LED = Output A
Right LED = Output B

1. Steady on indicated output is on
2. Flashing indicates output is faulted

For All Tables:

Short = ON 300ms and OFF 300ms
Long = OFF defined as 1.2 s
Pulse Width is ± 50ms



Example: C2 CANBUS Hardware Fault

| CIRCUIT PROTECTION

Buss Power

The module shall monitor Power Buss Bank current and shut off all bank outputs if the maximum current exceeds 13 amps per buss. Both short circuit and overcurrent protection is provided.

P1 = Ports 1 & 2 power, 13 amps.
P2 = Ports 3 & 4 power, 13 amps.

Module Power

The module power delivered by the CAN ports has both short circuit and overcurrent protection. This circuit has a separate ground that is supplied by the CAN port as well, Ground (A)

Output Power

This module has 4 amp outputs. The outputs have both short circuit and overcurrent protection. (See Figure 1)

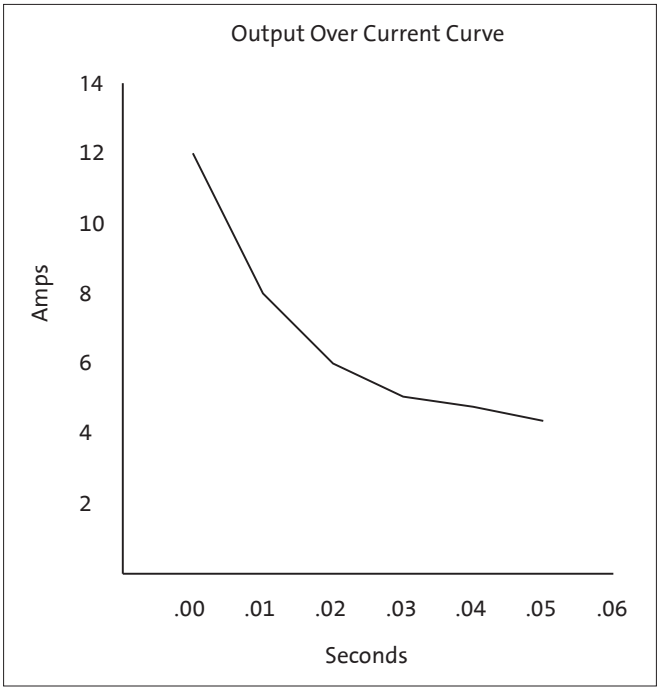
(8) 4A outputs

Reseting an output fault will require cycling of the module power unless the Controller Mode Output Reset is enabled. If the Controller Mode Output Reset is enabled the fault will be reset if the output is turned off, limit of 5 times before a cycle of module power will be required.

An output fault will not effect other outputs on the module.

Sec	Amps
.00	12
.01	8
.02	6
.03	5.3
.04	4.8
.05	4.4

Figure 1



| CONFIGURATION STEPS

Module default configuration:

- Factory Default Config returns 1 in Status message 1-Status 1, this should not be on if the module has been configured.
- Default operation of the module is on/off digital control. PWM control messages are not needed.
- Default configuration does not require a Command 0x52 message to enable operation.

Command 0x52 (This message only needs to be sent one time):

Value	Name	Data Type	Byte	Bits	Description
82 (0x52)	Command	Byte	1		Command for index pointer (which message your sending)
	Ctrl Mode Reset	2 bit	2	1,2	Enables Controller Mode Output Reset
	Enable Status 1 Msg			3,4	Enables the constant transmission of status message 1
	Enable Status 2 Msg			5,6	Enables the constant transmission of status message 2
	Enable Amp Msg			7,8	Enables the constant transmission of amperage messages
	Enable 24 vdc		3	1,2	Enables the low and over voltage fault limits for 24V DC system
	Save Configuration			3,4	Saves the configuration to the module (otherwise changes only valid until a power cycle occurs), set to 1 to write configuration to module
	Analog raw value			5,6	Sets all analog to be read in raw value as opposed to scaled (.005668/bit)
				7,8	
			4	1,2	
				3,4	
				5,6	
				7,8	
	FREQ1	Word	5		Sets the configuration of the frequency for all channels (30-1140 Hz)
			6		
	MODE1	4 Bit	7		Sets the configuration of ALL the outputs, overides Command 53 and 54. (0=Mode 1 Not Used, 1=ON/OFF, 2=Data 0-4000, 3= Percent 0-100.0%(0-1000), 4= Amps (0-4000ma) Can't be used in this mode.
	MODE2	4 Bit			Sets the configuration of the inputs.(0=Mode 2 Not Used, 1=Digital Positive, 2=Digital Ground) No analog.
	ID1	Byte	8		User defined byte for configuration ID, this will be transimitted in the STAT message.

- Module configuration message, needed when not using module default configuration.
- All Status messages need to be turned on (set to value of 1) to be received by controllers at the intervals customer sets.
- Enable 24V DC: Enables the low and over voltage fault limits for 24V DC system, otherwise feeding 24V DC to 12V DC system would cause system over voltage error. This is also used for the output overcurrent and short circuit detection.
- FREQ1: There needs to be a value put in this parameter or the outputs won't work.
- Mode 1: Configure all the outputs at the same time, override Command 0x53.
- Mode 2: Configure all the inputs at the same time, override Command 0x53 and 0x54.
- ID1: This is used to give a number to the node that will be transmitted back in Status Message 1-User ID. Default as 0, please note this User ID is not node ID (node address), please see "Configuring the Node ID" for setting node address.
- Save Configuration: Turn on the bits (value of 1) after configuring module, inputs and outputs, otherwise changes will only be saved until power cycle.

Command 0x53 & 54 (These messages only need to be sent one time):

- Configure individual input and output modes if they haven't been configured in Mode 1 and Mode 2 in Command 0x52.

Command 0x54, 55 & 56 (These messages only need to be sent one time, unless a change is made to one of the variables):

- Configure the Kp and Ki for any PWM current controls.

Command 0x57 (This message needs to be written all the time if a person is controlling the counter. A person needs to keep the counter on and needs to be able to reset the count):

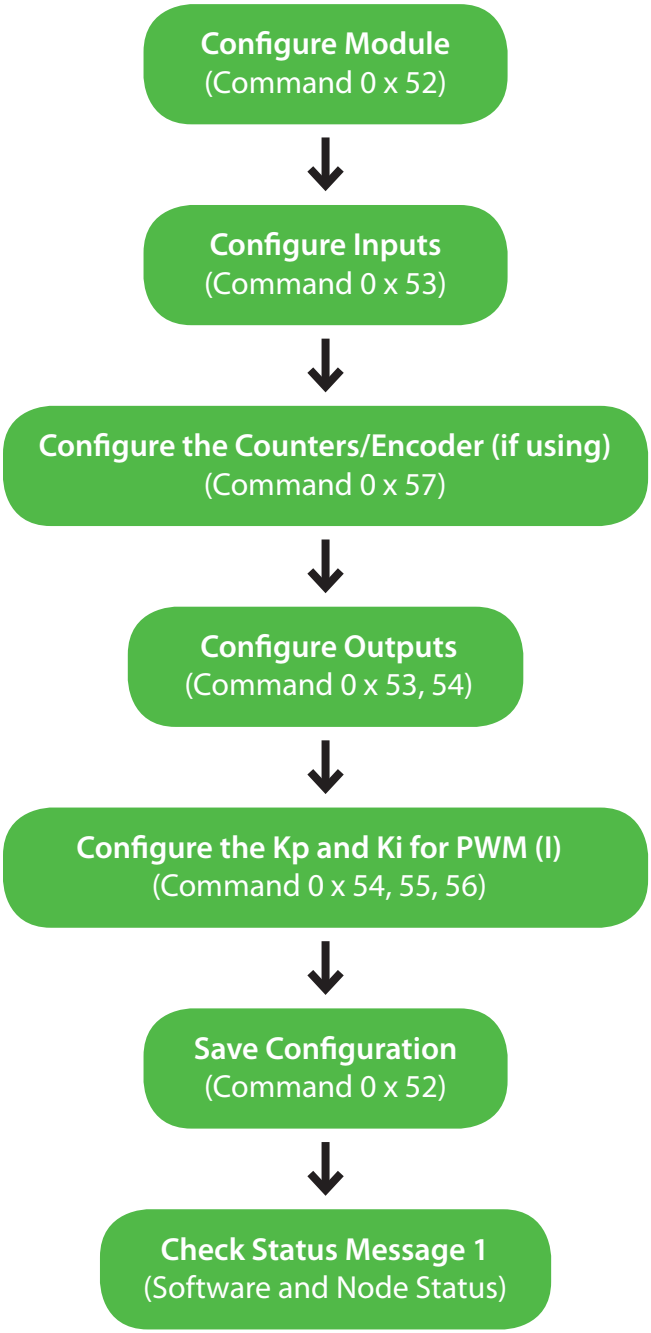
- Configure the counters/encoder if using.

Status messages - Status message 1 PGN (EF(Controller Source Address)):

- Status 1 – Factory default configuration returns a value of 1, this should not be on if a module has been configured.
- Status 2 – Configuration Saved returns a value of 1 if the alternate configuration was on (value of 1) and saved the configuration using "Save Configuration" in Command 52.
- Status 3 – Alternate configuration, a new configuration was made to the module but hasn't been saved.
- Status 9-14 – Returns a value of 1 each time a Command message 52-57 is sent, to ensure each configuration has been sent. This is on for a brief moment and then resets.

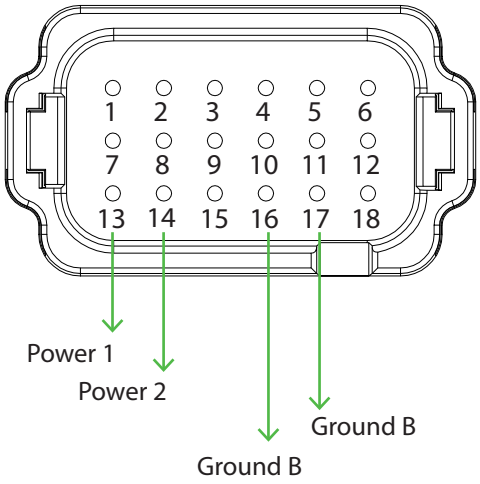
Command 0x51(Outputs digital control and Inputs power control) and PWM control messages need to be consistently sent. Please note PGNs are changing based on Node ID (node address), see section "PGNs USED" for details.

Configuration Sample Flowchart:



| POWERING THE OUTPUTS

Configuration & Power Plug



Power (Output only)
Power 1 = 13A for ports 1 & 2 (Outputs 1A, 1B, 2A, 2B)
Power 2 = 13A for ports 3 & 4 (Outputs 3A, 3B, 4A, 4B)

Ground B =
Output ground, internally connected to all Ground B pins

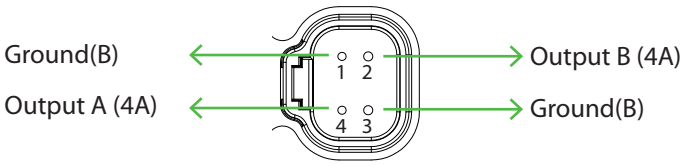
Please note that ALL module power connections need to be made in order to receive power on all output ports.

All Ground B connections are internally connected. All connections must be made to achieve the current rating of the block

A Ground B connection must be made for every 13A consumed by the block

| OUTPUT LAYOUT

Outputs (Ports 1-4)



Power
Pin 1 = Ground B
Pin 3 = Ground B

Configurations
1. Digital high side
2. PWM
3. PWM (I) Current Controlled

Amperage
All outputs = 4A

Outputs
- Port 1, Pin 4: Output 1A
- Port 1, Pin 2: Output 1B
- Port 2, Pin 4: Output 2A
- Port 2, Pin 2: Output 2B
- Port 3, Pin 4: Output 3A
- Port 3, Pin 2: Output 3B
- Port 4, Pin 4: Output 4A
- Port 4, Pin 2: Output 4B

All Ground (B) connections must be made in order to achieve the total specified current.

| CONFIGURING OUTPUTS

Output Mode

There are two ways to configure the outputs. All configuration is done through the same PGN. PGN 61408 is used for multiple messages by use of a different value put into the "command" byte of the PGN. This value is used a an index or pointer as to where the information goes in the module.

1. All Output Configuration

(only used if you want all the outputs to be configured the same)
Configuring all of the outputs is done through the "MODE1" byte in PGN 61408. The J1939 message structure,
The frequency set point must be greater than 0 for any output to function.

PGN
61408 (0xEFE0)
Source Address
209 (0xD1)
PDU Format
239 (0xEF)
PDU Specific
224 (0xE0)
Built Message
(0x18EFE0D1)

Transmit rate
50 ms
Msg timeout
200 ms
Priority
24 (0x18)

Command Value
82 (0x52)

Name	Data Type	Byte	Bits	Description
Command	Byte	1		Command for index pointer (which message your sending)
Ctrl Mode Reset	2 bit	2	1,2	Enables Controller Mode Output Reset
Enable Status 1 Msg			3,4	Enables the constant transmission of status message 1
Enable Status 2 Msg			5,6	Enables the constant transmission of status message 2
Enable Amp Msg			7,8	Enables the constant transmission of amperage messages
Enable 24V DC		3	1,2	Enables the low and over voltage fault limits for 24V DC system
Save Configuration			3,4	Saves the configuration to the module (otherwise changes only valid until a power cycle occurs), set to 1 to write configuration to module
Analog raw value			5,6	Internal Use Only
			7,8	
		4	1,2	
			3,4	
			5,6	
			7,8	
FREQ1	Word	5		Sets the configuration of the frequency for all channels (**30-1140 Hz**)
		6		
MODE1	4 Bit	7		Sets the configuration of **ALL** the outputs, overides Command 53 and 54. (**0=Mode 1 Not Used, 1=ON/OFF, 2=Data 0-4000, 3= Percent 0-100.0%(0-1000), 4= Amps (0-4000ma) Can't be used in this mode**
MODE2	4 Bit	7		Sets the configuration of the inputs.(0=Mode 2 Not Used, 1=Digital Positive, 2=Digital Ground) **No analog**
ID1	Byte	8		User defined byte for configuration ID, this will be transimitted in the STAT message.

2. Individual Configuration

Individual output configuration is done through the "output mode" nibble in PGN 61408

PGN
61408 (0xEFE0)
Source Address
209 (0xD1)
PDU Format
239 (0xEF)
PDU Specific
224 (0xE0)
Built Message
(0x18EFE0D1)

Transmit rate
50 ms
Msg timeout
200 ms
Priority
24 (0x18)

Value
83 (0x53)

Name	Data Type	Byte	Bits	Description
Command	Byte	1		Command for index pointer (which message you're sending)
OUTMODE1A	4 bit	2	1,2,3,4	Mode 0x0=disabled, 0x1=On/Off, 0x2=Data(0-4000), 0x3=Percent(0-1000 = 0-100.0%), 0x4=Amps(0-4000 = 0-4.000A)
OUTMODE1B			5,6,7,8	
OUTMODE2A		3	1,2,3,4	
OUTMODE2B			5,6,7,8	
OUTMODE3A		4	1,2,3,4	
OUTMODE3B			5,6,7,8	
OUTMODE4A		5	1,2,3,4	
OUTMODE4B			5,6,7,8	
INMODE5A	4 bit	6	1,2,3,4	Mode 0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground
INMODE5B			5,6,7,8	Mode 0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x3= 4-20ma (4000-20000), 0x4= 0-5V DC (0-5000, 0x5= 0-10V DC (0-10000), 0x6= 0-32V DC(0-32000), 0x9= Ratiometric (0-100.0% of source V DC)
INMODE6A		7	1,2,3,4	Mode 0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground
INMODE6B			5,6,7,8	Mode 0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x3= 4-20ma (4000-20000), 0x4= 0-5V DC (0-5000, 0x5= 0-10vdc (0-10000), 0x6= 0-32V DC(0-32000), 0x9= Ratiometric (0-100.0% of source V DC)
INMODE7A		8	1,2,3,4	Mode 0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x7=Digital Positive Frequency, 0x8= High Speed Counter, 0xA = Encoder
INMODE7B			5,6,7,8	Mode 0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x3= 4-20ma (4000-20000), 0x4= 0-5V DC (0-5000, 0x5= 0-10vdc (0-10000), 0x6= 0-32V DC(0-32000), 0x9= Ratiometric (0-100.0% of source V DC)

3. Modes

Using a value of 0 - 4 will select the configuration of the output

[MODE#X]	Output Operation	Notes
0x0h	Disabled	Not Used
0x1h	ON/OFF	ON/OFF
0x2h	Data (0 – 4000)	PWMx = 12 bits 0-4000
0x3h	Percent (0% – 100.0%)	PWMx = 12 bits 0-1000
0x4h	Amps (0A – 4.000)	PWMx = 12 bits 0-4000
0xFh	Not Used	Invalid Output Configuration

| OUTPUT OPERATION

The output operation will be different depending on the configuration chosen for the output.

1. Disabled, MODE = 0

It is recommended to disable any outputs that aren't being used. Putting a "0" in the mode for an output disables the output and prevents it from being turned on.

2. On/Off, MODE = 1 (Used for Discrete Operation)

This puts the output into the standard discrete operation mode. The use of bit pairs in Control Message 1 of PGN 61408 will turn the output on or off.

	High Bit	Low Bit
On	0	1
Off	0	0

3. Data, MODE = 2 (Used for PWM Control using a value of 0-4000)

This puts the output into PWM control with a value of 0 - 4000 equaling 0 - 100% of the duty cycle. Two bytes are allocated for each of the PWM control messages with the first 12 bits being used for the value. The first byte and the first 4 bits of the second byte are put together for 12 bit control of the output.

	Second Byte				First Byte							
	Bit 4	Bit 3	Bit 2	Bit 1	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1
2000	0	1	1	1	1	1	0	1	0	0	0	0

The last two bits of the second byte are used to choose a direction for the paired outputs.

	Second Byte	
	Bit 8	Bit 7
Out "B"	0	1
Out "A"	0	0

With a value greater than zero in the PWM command and a zero in the direction bit, output A will turn on. If the direction bit is set to a one, output B will turn on.

4. Percent, MODE = 3 (Used for PWM Control using a value of 0-1000 (= 0-100.0%))

This puts the output into PWM control with a value of 0 - 1000 equaling 0 - 100.0% of the duty cycle. Two bytes are allocated for each of the PWM control messages with the first 12 bits being used for the value. The first byte and the first 4 bits of the second byte are put together for 12 bit control of the output.

	Second Byte				First Byte							
	Bit 4	Bit 3	Bit 2	Bit 1	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1
500	0	0	0	1	1	1	1	1	0	1	0	0

The last two bits of the second byte are used to choose a direction for the paired outputs.

	Second Byte	
	Bit 8	Bit 7
Out "B"	0	1
Out "A"	0	0

With a value greater than zero in the PWM command and a zero in the direction bit, output A will turn on. If the direction bit is set to a one, output B will turn on.

5. Amps, MODE = 4 (Used for PWM (I) Control)

This puts the output into PWM current control with a value of 0 - 4000 equaling 0 - 4000mA. Two bytes are allocated for each of the PWM control messages with the first 12 bits being used for the value. The first byte and the first 4 bits of the second byte are put together for 12 bit control of the output.

	Second Byte				First Byte							
	Bit 4	Bit 3	Bit 2	Bit 1	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1
2000	0	1	1	1	1	1	0	1	0	0	0	0

The last two bits of the second byte are used to choose a direction for the paired outputs.

	Second Byte	
	Bit 8	Bit 7
Out "B"	0	1
Out "A"	0	0

With a value greater than zero in the PWM command and a zero in the direction bit, output A will turn on. If the direction bit is set to a one, output B will turn on.

PWM (I) Commands

The PWM(I) control has more status and control commands than the standard PWM control. The module takes a setpoint for the current control and closes the loop according to the values put into the Kp and Ki. The module also sends the current reading back via a current status message. All commands and status are shown below.

A. Loop Tuning (Kp and Ki)

J1939 Output Configuration 3					
Value	**Name**	**Data Type**	**Byte**	**Bits**	**Description**
84 (0x54)	Command	Byte	1		Command for index pointer (which message your sending)
	INMODE8A	4 bit	2	1,2,3,4	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x7=Digital Positive Frequency, 0x8= High Speed Counter**
	INMODE8B			5,6,7,8	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x3= 4-20ma (4000-20000), 0x4= 0-5V DC (0-5000, 0x5= 0-10V DC (0-10000), 0x6= 0-32V DC (0-32000), 0x9= Ratiometric (0-100.0% of source V DC)**
	Port 1A Kp	Byte	3		Output 1A proportional set point (0-250 = 0-2.50, >250=0) **default 100**
	Port 1A Ki		4		Output 1A integral set point (0-250 = 0-2.50, >250=0) **default 100**
	Port 1B Kp		5		Output 1B proportional set point (0-250 = 0-2.50, >250=0) **default 100**
	Port 1B Ki		6		Output 1B integral set point (0-250 = 0-2.50, >250=0) **default 100**
	Port 2A Kp		7		Output 2A proportional set point (0-250 = 0-2.50, >250=0) **default 100**
	Port 2A Ki		8		Output 2A integral set point (0-250 = 0-2.50, >250=0) **default 100**

J1939 Output Configuration 4					
Value	**Name**	**Data Type**	**Byte**	**Bits**	**Description**
85 (0x55)	Command	Byte	1		Command for index pointer (which message your sending)
	Port 2B Kp		2		Output 2B proportional set point (0-250 = 0-2.50, >250=0) **default 100**
	Port 2B Ki		3		Output 2B integral set point (0-250 = 0-2.50, >250=0) **default 100**
	Port 3A Kp		4		Output 3A proportional set point (0-250 = 0-2.50, >250=0) **default 100**
	Port 3A Ki		5		Output 3A integral set point (0-250 = 0-2.50, >250=0) **default 100**
	Port 3B Kp		6		Output 3B proportional set point (0-250 = 0-2.50, >250=0) **default 100**
	Port 3B Ki		7		Output 3B integral set point (0-250 = 0-2.50, >250=0) **default 100**
	Not used		8		Output 2A proportional set point (0-250 = 0-2.50, >250=0) **default 100**

J1939 Output Configuration 4					
Value	**Name**	**Data Type**	**Byte**	**Bits**	**Description**
85 (0x56)	Command	Byte	1		Command for index pointer (which message your sending)
	Port 4A Kp		2		Output 4A proportional set point (0-250 = 0-2.50, >250=0) **default 100**
	Port 4A Ki		3		Output 4A integral set point (0-250 = 0-2.50, >250=0) **default 100**
	Port 4B Kp		4		Output 4B proportional set point (0-250 = 0-2.50, >250=0) **default 100**
	Port 4B Ki		5		Output 4B integral set point (0-250 = 0-2.50, >250=0) **default 100**
	Not used		6		
	Not used		7		
	Not used		8		

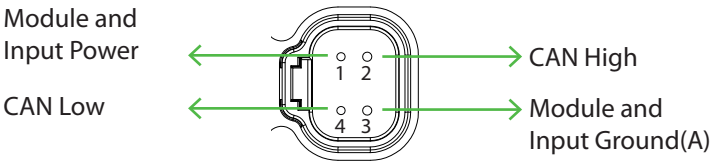
B. Amperage Feedback

Status Message 4 (Ouput Amperage Feedback OUT 1A-4B)				
Name	**Data Type**	**Byte**	**Bits**	**Description**
OUT 1A AMP FEEDBACK	Word	1		Current reading on Output 1A, 0-4000 = 0-4.000 amps
		2		
OUT 1B AMP FEEDBACK	Word	3		Current reading on Output 1B, 0-4000 = 0-4.000 amps
		4		
OUT 2A AMP FEEDBACK	Word	5		Current reading on Output 2A, 0-4000 = 0-4.000 amps
		6		
OUT 2B AMP FEEDBACK	Word	7		Current reading on Output 2B, 0-4000 = 0-4.000 amps
		8		

Status Message 5 (Ouput Amperage Feedback OUT 5A-8B)				
Name	**Data Type**	**Byte**	**Bits**	**Description**
OUT 3A AMP FEEDBACK	Word	1		Current reading on Output 3A, 0-4000 = 0-4.000 amps
		2		
OUT 3B AMP FEEDBACK	Word	3		Current reading on Output 3B, 0-4000 = 0-4.000 amps
		4		
OUT 4A AMP FEEDBACK	Word	5		Current reading on Output 4A, 0-4000 = 0-4.000 amps
		6		
OUT 4B AMP FEEDBACK	Word	7		Current reading on Output 4B, 0-4000 = 0-4.000 amps
		8		

| POWERING THE INPUTS

CAN Ports 1 & 2 Non-Isolated



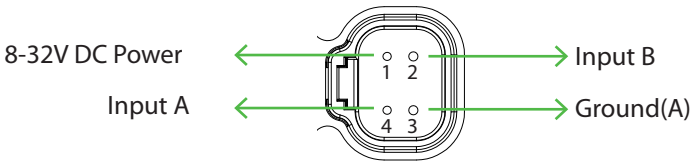
Power (Module and Input, 13A)
Pin 1 = 8-32V DC
Pin 3 = Ground (A)

Please note that module and input power is provided via the CAN port

All Ground (A) connections are internally connected and are isolated from Ground (B)!

| INPUT LAYOUT

Inputs (Ports 5-8)



Power
Pin 1 = 8-32V DC
Pin 3 = Ground A

Configurations
Input A
1. Digital Positive
2. Digital Ground
3. Frequency/Counter/Encoder (7A & 8A)

Input B
1. Digital Positive
2. Digital Ground
3. 4-20mA
4. 0-5V DC
5. 0-10V DC
6. 0-32V DC
7. Ratiometric

Inputs
• Port 5, Pin 4: Input 5A
• Port 5, Pin 2: Input 5B

• Port 6, Pin 4: Input 6A
• Port 6, Pin 2: Input 6B

• Port 7, Pin 4: Input 7A
• Port 7, Pin 2: Input 7B

• Port 8, Pin 4: Input 8A
• Port 8, Pin 2: Input 8B

| CONFIGURING INPUTS

Input Mode

There are two ways to configure the inputs. All configuration is done through the same PGN. PGN 61408 is used for multiple messages by use of a different value put into the "Command" byte of the PGN. This value is used as an index or pointer as to where the information goes in the module.

1. All Input Configuration

(Only used if you want all the inputs to be configured the same. Only works for digital configuration.)
Configuring all of the inputs is done through the "MODE2" byte in PGN 61408. The J1939 message structure,

PGN
61408 (0xEFE0)
Source Address
209 (0xD1)
PDU Format
239 (0xEF)
PDU Specific
224 (0xE0)
Built Message
(0x18EFE0D1)

Transmit rate
50 ms
Msg timeout
200 ms
Priority
24 (0x18)

Command Value
82 (0x52)

Name	Data Type	Byte	Bits	Description
Command	Byte	1		Command for index pointer (which message you're sending)
Ctrl Mode Reset	2 bit	2	1,2	Enables Controller Mode Output Reset
Enable Status 1 Msg			3,4	Enables the constant transmission of status message 1
Enable Status 2 Msg			5,6	Enables the constant transmission of status message 2
Enable Amp Msg			7,8	Enables the constant transmission of amperage messages
Enable 24V DC		3	1,2	Enables the low and over voltage fault limits for 24V DC system
Save Configuration			3,4	Saves the configuration to the module (otherwise changes only valid until a power cycle occurs), set to 1 to write configuration to module
Analog raw value			5,6	Internal Use Only
			7,8	
		4	1,2	
			3,4	
			5,6	
			7,8	
FREQ1	Word	5		Sets the configuration of the frequency for all channels (**30-1140 Hz**)
		6		
MODE1	4 Bit	7		Sets the configuration of **ALL** the outputs, overides Command 53 and 54. (**0=Mode 1 Not Used, 1=ON/OFF, 2=Data 0-4000, 3= Percent 0-100.0%(0-1000)**, **4= Amps (0-4000ma) Can't be used in this mode**
MODE2	4 Bit	7		Sets the configuration of the inputs.(0=Mode 2 Not Used, 1=Digital Positive, 2=Digital Ground) **No analog**
ID1	Byte	8		User defined byte for configuration ID, this will be transimitted in the STAT message.

2. Individual Configuration

Individual input configuration is done through the "input mode" nibble in PGN 61408

PGN
61408 (0xEFE0)
Source Address
209 (0xD1)
PDU Format
239 (0xEF)
PDU Specific
224 (0xE0)
Built Message
(0x18EFE0D1)

Transmit rate
50 ms
Msg timeout
200 ms
Priority
24 (0x18)

Value
83 (0x53)

Name	Data Type	Byte	Bits	Description
Command	Byte	1		Command for index pointer (which message you're sending)
OUTMODE1A	4 bit	2	1,2,3,4	Mode 0x0=disabled, 0x1=On/Off, 0x2=Data(0-4000), 0x3=Percent(0-1000 = 0-100.0%), 0x4=Amps(0-4000 = 0-4.000A)
OUTMODE1B			5,6,7,8	
OUTMODE2A		3	1,2,3,4	
OUTMODE2B			5,6,7,8	
OUTMODE3A		4	1,2,3,4	
OUTMODE3B			5,6,7,8	
OUTMODE4A		5	1,2,3,4	
OUTMODE4B			5,6,7,8	
INMODE5A	4 bit	6	1,2,3,4	Mode 0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground
INMODE5B			5,6,7,8	Mode 0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x3= 4-20ma (4000-20000), 0x4= 0-5V DC (0-5000, 0x5= 0-10V DC (0-10000), 0x6= 0-32V DC(0-32000), 0x9= Ratiometric (0-100.0% of source V DC)
INMODE6A		7	1,2,3,4	Mode 0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground
INMODE6B			5,6,7,8	Mode 0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x3= 4-20ma (4000-20000), 0x4= 0-5V DC (0-5000, 0x5= 0-10vdc (0-10000), 0x6= 0-32V DC(0-32000), 0x9= Ratiometric (0-100.0% of source V DC)
INMODE7A		8	1,2,3,4	Mode 0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x7=Digital Positive Frequency, 0x8= High Speed Counter
INMODE7B			5,6,7,8	Mode 0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x3= 4-20ma (4000-20000), 0x4= 0-5V DC (0-5000, 0x5= 0-10vdc (0-10000), 0x6= 0-32V DC(0-32000), 0x9= Ratiometric (0-100.0% of source V DC)

Value
84 (0x54)

Name	Data Type	Byte	Bits	Description
Command	Byte	1		Command for index pointer (which message your sending)
INMODE8A	4 bit	2	1,2,3,4	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x7=Digital Positive Frequency, 0x8= High Speed Counter**
INMODE8B			5,6,7,8	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x3= 4-20ma (4000-20000), 0x4= 0-5V DC (0-5000, 0x5= 0-10V DC (0-10000), 0x6= 0-32V DC (0-32000), 0x9= Ratiometric (0-100.0% of source V DC)**
Port 1A Kp	Byte	3		Output 1A proportional set point (0-250 = 0-2.50, >250=0) **default 100**
Port 1A Ki		4		Output 1A integral set point (0-250 = 0-2.50, >250=0) **default 100**
Port 1B Kp		5		Output 1B proportional set point (0-250 = 0-2.50, >250=0) **default 100**
Port 1B Ki		6		Output 1B integral set point (0-250 = 0-2.50, >250=0) **default 100**
Port 2A Kp		7		Output 2A proportional set point (0-250 = 0-2.50, >250=0) **default 100**
Port 2A Ki		8		Output 2A integral set point (0-250 = 0-2.50, >250=0) **default 100**

3. Modes

Digital

Using a value of 0 - 7 will select the configuration of input A

[MODE#X]	Input Operation	Notes
0x0h	Disabled	This Mode Not Used
0x1h	Positive	ON/OFF
0x2h	Ground	ON/OFF
0x7h	Frequency	See Section on Frequency
0x8h	Counter	See Section on Counter
0xFh	Not Used	Invalid Output Configuration

Analog

Using a value of 0 - 9 will select the configuration of input B

[MODE#X]	Input Operation	Notes
0x0h	Disabled	This Mode Not Used
0x1h	Positive	ON/OFF
0x2h	Ground	ON/OFF
0x3h	4-20mA	4-20mA =4,000-20,000 scaled reading
0x4h	0-5V DC	0-5V DC = 0-5,000 scaled reading
0x5h	0-10V DC	0-10V DC = 0-10,000 scaled reading
0x6h	0-32V DC	0-32V DC = 0-32,000 scaled reading
0x9h	Ratiometric	0-1000 = 0-100.0%
0xFh	Not Used	Invalid Output Configuration

| INPUT OPERATION

The input operation will be different depending on the configuration chosen for the input and the input pin being configured.
Input power for each port needs to be enabled to recevie 9-32V DC on pin1, See Control Message 1.

Input A

1. Disabled, MODE = 0

It is recommended to disable any inputs that aren't being used. Putting a "0" in the mode for an input disables the input.

2. Positive On/Off, MODE = 1

This puts the input into the standard discrete positive operation mode. When a positive voltage is present on the input pin, the low bit will turn on.

	High Bit	Low Bit
On	0	1
Off	0	0

3. Ground On/Off, MODE = 2

This puts the input into the standard discrete ground operation mode. When a ground is present on the input pin, the low bit will turn on.

4. Frequency, MODE = 7

This puts the input into frequency operation mode. When a positive signal is present on the input pin, the frequency will be shown.

5. Counter, MODE = 8

This puts the input into counter operation mode. When a positive signal is present on the input pin, the count will increase.

6. Encoder, MODE = A

This puts the input 7A into Encoder operation mode. When a positive signal is present on the input pin, the count will increase. Both Input 7A and 8A are used for the encoder input, when changing Input 7A to encoder mode, it automatically sets up 8A to work with it.

Input B

1. Disabled, MODE = 0

It is recommended to disable any inputs that aren't being used. Putting a "0" in the mode for an input disables it.

2. Positive On/Off, MODE = 1

This puts the input into the standard discrete positive operation mode. When a positive voltage is present on the input pin, the low bit will turn on.

	High Bit	Low Bit
On	0	1
Off	0	0

3. Ground On/Off, MODE = 2

This puts the input into the standard discrete ground operation mode. When a ground is present on the input pin, the low bit will turn on.

	High Bit	Low Bit
On	0	1
Off	0	0

4. 4-20mA, MODE = 3

This puts the input into 4-20mA mode with a value of 4,000 - 20,000 = 4,000 - 20,000Ma. A word is allocated for this input. The 1st byte is the low byte and the 2nd byte is the high byte.

	Second Byte (High Byte)								First Byte (Low Byte)							
	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1
4000=	0	0	0	0	1	1	1	1	1	0	1	0	0	0	0	0

5. 0-5V DC, MODE = 4

This puts the input into 0-5V DC mode with a value of 0 - 5,000 = 0 - 5,000mV. A word is allocated for this input. The 1st byte is the low byte and the 2nd byte is the high byte.

	Second Byte (High Byte)								First Byte (Low Byte)							
	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1
4000=	0	0	0	0	1	1	1	1	1	0	1	0	0	0	0	0

6. 0-10V DC, MODE = 5

This puts the input into 0-10V DC mode with a value of 0 - 10,000 = 0 - 10,000mV. A word is allocated for this input. The 1st byte is the low byte and the 2nd byte is the high byte.

	Second Byte (High Byte)								First Byte (Low Byte)							
	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1
4000=	0	0	0	0	1	1	1	1	1	0	1	0	0	0	0	0

7. 0-32V DC, MODE = 6

This puts the input into 0-32V DC mode with a value of 0 - 32,000 = 0 - 32,000mV. A word is allocated for this input. The 1st byte is the low byte and the 2nd byte is the high byte.

	Second Byte (High Byte)								First Byte (Low Byte)							
	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1
4000=	0	0	0	0	1	1	1	1	1	0	1	0	0	0	0	0

8. Ratiometric, MODE = 9

This puts the input into Ratiometric mode with a value of 0 - 1,000 equaling 0 - 100.0%. This input will show the percentage of voltage being read compared to the source voltage The 1st byte is the low byte and the 2nd byte is the high byte.

	Second Byte (High Byte)								First Byte (Low Byte)							
	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1
100=	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0

| FREQ./COUNTER/ENCODER OPERATION

FREQUENCY

1. The input must be put into Frequency MODE = 7 (Only valid on input 7A & 8A)

This puts the Input into frequency operation mode. When a positive signal is present on the input pin, the frequency will be shown.

Value
83 (0x53)

Name	Data Type	Byte	Bits	Description
Command	Byte	1		Command for index pointer (which message you're sending)
OUTMODE1A	4 bit	2	1,2,3,4	Mode **0x0=disabled, 0x1=On/Off, 0x2=Data(0-4000), 0x3=Percent(0-1000 = 0-100.0%), 0x4=Amps(0-4000 = 0-4.000A)**
OUTMODE1B			5,6,7,8	
OUTMODE2A		3	1,2,3,4	
OUTMODE2B			5,6,7,8	
OUTMODE3A		4	1,2,3,4	
OUTMODE3B			5,6,7,8	
OUTMODE4A		5	1,2,3,4	
OUTMODE4B			5,6,7,8	
INMODE5A		6	1,2,3,4	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground**
INMODE5B			5,6,7,8	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x3= 4-20mA (4000-20000), 0x4= 0-5V DC (0-5000, 0x5= 0-10V DC (0-10000), 0x6= 0-32V DC(0-32000), 0x9= Ratiometric (0-100.0% of source V DC)**
INMODE6A		7	1,2,3,4	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground**
INMODE6B			5,6,7,8	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x3= 4-20mA (4000-20000), 0x4= 0-5V DC (0-5000, 0x5= 0-10V DC (0-10000), 0x6= 0-32V DC(0-32000), 0x9= Ratiometric (0-100.0% of source V DC)**
INMODE7A	4 bit	8	1,2,3,4	**Mode 0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x7=Digital Positive Frequency, 0x8= High Speed Counter, 0xA=Encoder**
INMODE7B	4 bit	8	5,6,7,8	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x3= 4-20mA (4000-20000), 0x4= 0-5V DC (0-5000, 0x5= 0-10V DC (0-10000), 0x6= 0-32V DC(0-32000), 0x9= Ratiometric (0-100.0% of source V DC)**

Value
84 (0x54)

Name	Data Type	Byte	Bits	Description
Command	Byte	1		Command for index pointer (which message your sending)
INMODE8A	4 bit	2	1,2,3,4	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x7=Digital Positive Frequency, 0x8= High Speed Counter**
INMODE8B	4 bit	2	5,6,7,8	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x3= 4-20ma (4000-20000), 0x4= 0-5V DC (0-5000, 0x5= 0-10V DC (0-10000), 0x6= 0-32V DC (0-32000), 0x9= Ratiometric (0-100.0% of source V DC)**
Port 1A Kp	Byte	3		Output 1A proportional set point (0-250 = 0-2.50, >250=0) **default 100**
Port 1A Ki		4		Output 1A integral set point (0-250 = 0-2.50, >250=0) **default 100**
Port 1B Kp		5		Output 1B proportional set point (0-250 = 0-2.50, >250=0) **default 100**
Port 1B Ki		6		Output 1B integral set point (0-250 = 0-2.50, >250=0) **default 100**
Port 2A Kp		7		Output 2A proportional set point (0-250 = 0-2.50, >250=0) **default 100**
Port 2A Ki		8		Output 2A integral set point (0-250 = 0-2.50, >250=0) **default 100**

2. The Hertz and Duty Cycle are shown in the message below

PGN
65307 (0xFF1B)
Source Address
224 (0xE0)
PDU Format
255 (0xFF)
PDU Specific
27 (0x1B)
Built Message
(0x18FF1BE0)

Name	Data Type	Byte	Bits	Description
Hertz_Count Input 7A	Word	1	Low Byte	Input 7A, **Hertz** is used when the input is configured as a frequency input, **Count** is used when the input is configured as a high speed counter
		2	High Byte	
Duty Cycle_ SP Input 7A	Word	3	Low Byte	Input 7A, **Duty Cycle** is used when the input is configured as a frequency input, **Set Point** is used when the input is configured as a high speed counter
		4	High Byte	
Hertz_Count Input 8A	Word	5	Low Byte	Input 8A, **Hertz** is used when the input is configured as a frequency input, **Count** is used when the input is configured as a high speed counter
		6	High Byte	
Duty Cycle_SP Input 8A	Word	7	Low Byte	Input 8A, **Duty Cycle** is used when the input is configured as a frequency input, **Set Point** is used when the input is configured as a high speed counter
		8	High Byte	

COUNTER/ENCODER

1. The input must be put into Counter MODE = 8 (Only valid on input 7A & 8A)

This puts the Input into counter operation mode. When a positive signal is present on the input pin, the count will start to accrue.

Value
83 (0x53)

Name	Data Type	Byte	Bits	Description
Command	Byte	1		Command for index pointer (which message you're sending)
OUTMODE1A	4 bit	2	1,2,3,4	Mode **0x0=disabled, 0x1=On/Off, 0x2=Data(0-4000), 0x3=Percent(0-1000 = 0-100.0%), 0x4=Amps(0-4000 = 0-4.000A)**
OUTMODE1B			5,6,7,8	
OUTMODE2A		3	1,2,3,4	
OUTMODE2B			5,6,7,8	
OUTMODE3A		4	1,2,3,4	
OUTMODE3B			5,6,7,8	
OUTMODE4A		5	1,2,3,4	
OUTMODE4B			5,6,7,8	
INMODE5A		6	1,2,3,4	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground**
INMODE5B			5,6,7,8	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x3= 4-20mA (4000-20000), 0x4= 0-5V DC (0-5000, 0x5= 0-10V DC (0-10000), 0x6= 0-32V DC(0-32000), 0x9= Ratiometric (0-100.0% of source V DC)**
INMODE6A		7	1,2,3,4	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground**
INMODE6B			5,6,7,8	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x3= 4-20mA (4000-20000), 0x4= 0-5V DC (0-5000, 0x5= 0-10V DC (0-10000), 0x6= 0-32V DC(0-32000), 0x9= Ratiometric (0-100.0% of source V DC)**
INMODE7A	4 bit	8	1,2,3,4	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x7=Digital Positive Frequency, 0x8= High Speed Counter, 0xA=Encoder**
INMODE7B	4 bit	8	5,6,7,8	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x3= 4-20mA (4000-20000), 0x4= 0-5V DC (0-5000, 0x5= 0-10V DC (0-10000), 0x6= 0-32V DC(0-32000), 0x9= Ratiometric (0-100.0% of source V DC)**

Value
84 (0x54)

Name	Data Type	Byte	Bits	Description
Command	Byte	1		Command for index pointer (which message your sending)
INMODE8A	4 bit	2	1,2,3,4	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x7=Digital Positive Frequency, 0x8= High Speed Counter**
INMODE8B	4 bit	2	5,6,7,8	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x3= 4-20ma (4000-20000), 0x4= 0-5V DC (0-5000, 0x5= 0-10V DC (0-10000), 0x6= 0-32V DC (0-32000), 0x9= Ratiometric (0-100.0% of source V DC)**
Port 1A Kp	Byte	3		Output 1A proportional set point (0-250 = 0-2.50, >250=0) **default 100**
Port 1A Ki		4		Output 1A integral set point (0-250 = 0-2.50, >250=0) **default 100**
Port 1B Kp		5		Output 1B proportional set point (0-250 = 0-2.50, >250=0) **default 100**
Port 1B Ki		6		Output 1B integral set point (0-250 = 0-2.50, >250=0) **default 100**
Port 2A Kp		7		Output 2A proportional set point (0-250 = 0-2.50, >250=0) **default 100**
Port 2A Ki		8		Output 2A integral set point (0-250 = 0-2.50, >250=0) **default 100**

*****Encoder Mode: both 7A and 7B are used for the encoder input. When changing 7A to encoder it automatically sets up 8A to work with it.**

2. Configure the Counter in the message below

Value
87 (0x57)

Name	Data Type	Byte	Bits	Description
Command	Byte	1		Command for index pointer (which message you're sending)
Counter 7A On/Off	2 bit	2	1,2	Enable Counter 7A, 00 = Off, 01 = On (used in encoder mode)
Counter 7A Reset			3,4	Reset Counter 7A, 00 = Off, 01 = On (used in encoder mode)
Counter 7A Roll-Over Enabled			5,6	Enable Counter 7A Rollover, count continues after set point is achieved, 00 = Off, 01 = On (not used in encoder mode)
Counter 7A Enable Out 3A			7,8	Enable Output 3A when Counter 7A is enabled and set point hasn't been reached, 00 = Off, 01 = On (not used in encoder mode)
Counter 8A On/Off		3	1,2	Enable Counter 8A, 00 = Off, 01 = On (not used in encoder mode)
Counter 8A Reset			3,4	Reset Counter 8A, 00 = Off, 01 = On (not used in encoder mode)
Counter 8A Roll-Over Enabled			5,6	Enable Counter 8A Rollover, count continues after set point is achieved, 00 = Off, 01 = On (not used in encoder mode)
Counter 8A Enable Out 4A			7,8	Enable Output 4A when Counter 8A is enabled and set point hasn't been reached, 00 = Off, 01 = On (not used in encoder mode)
Spare		4	1,2	Not used on this module
			3,4	
			5,6	
			7,8	
Counter 7A Set Point	Word	5		Set point for totalalized count on Counter 7A
		6		
Counter 8A Set Point	Word	7		Set point for totalalized count on Counter 8A
		8		

Set a value of 1 to "Counter 7A Enable Out 3A" provides an Enable function for Output3A. Output3A is disabled when counter > = Set Point.
Set a value of 1 to "Counter 8A Enable Out 4A" provides and Enable function for Output4A. Output4A is disabled when counter > = Set Point.

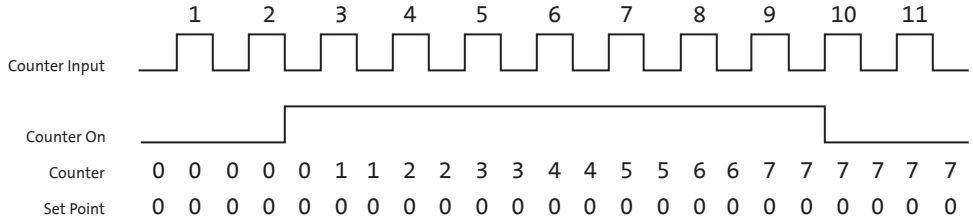
NOTES

1. Turning off the counter doesn't reset the accumulative value of the counter, a reset is required to reset the count.
2. If roll-over isn't selected the counter will only accrue up to the setpoint entered.
3. Designated outputs can be controlled by the counter to work asynchronous to the controller, when setpoint has been reached, the output will shut off if the enable bit is on. Please note the output must be turned on as it will not automatically turn on when the counter is on.
4. Turning the counter OFF will not clear the current count value or set point.
5. A counter reset does not clear the counter set point.
6. A counter reset will clear the current count and does not turn the counter OFF.
7. The Roll-Over signal will not change the Output3A and Output4A Enable function.

COUNTER OPERATION EXAMPLES

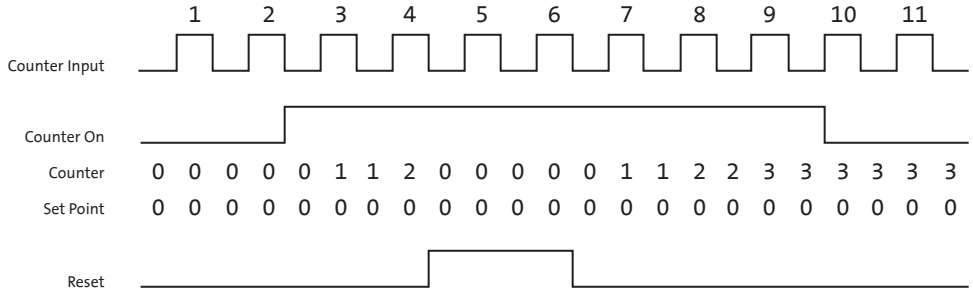
Counter Basic

Set Point zero, Reset off, Roll Over off



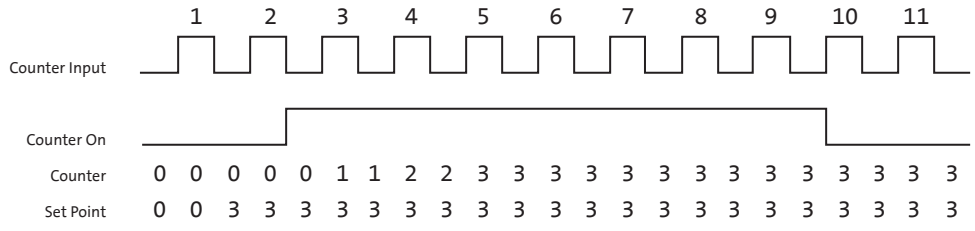
Counter - Using Reset

Set Point zero, Roll Over off

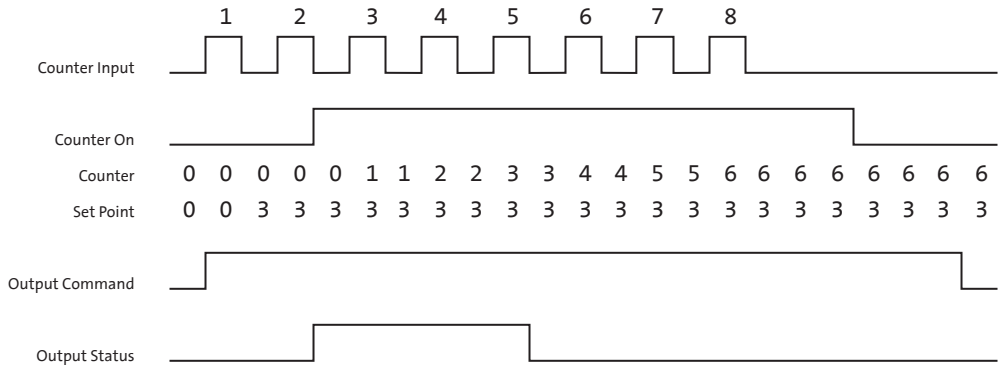


Counter - Using Set Point

Set Point set, Reset off, Roll Over off



Counter - Roll Over and Output Enable
Set Point set, Reset off, Roll Over on, Output Enable on



ENCODER OPERATION

- Input 7A & 8A are used for encoder mode. Channel A of the encoder is connected to Input 7A & Channel B is connected to Input 8A.
- When the encoder channels are correctly connected, as shown above, firmware takes care of incrementing or decrementing the count.
- The functions that work when using encoder mode are tied to counter 7A, the on/off & reset are the only commands that work at this time.

2. The Count and Counter Set Point are shown in the message below/Encoder

PGN
65307 (0xFF1B)
Source Address
224 (0xE0)
PDU Format
255 (0xFF)
PDU Specific
27 (0x1B)
Built Message
(0x18FF1BE0)

Name	Data Type	Byte	Bits	Description
Hertz_Count Input 7A	Word	1	Low Byte	Input 7A, **Hertz** is used when the input is configured as a frequency input, **Count** is used when the input is configured as a high speed counter
		2	High Byte	
Duty Cycle_ SP Input 7A	Word	3	Low Byte	Input 7A, **Duty Cycle** is used when the input is configured as a frequency input, **Set Point** is used when the input is configured as a high speed counter
		4	High Byte	
Hertz_Count Input 8A	Word	5	Low Byte	Input 8A, **Hertz** is used when the input is configured as a frequency input, **Count** is used when the input is configured as a high speed counter
		6	High Byte	
Duty Cycle_SP Input 8A	Word	7	Low Byte	Input 8A, **Duty Cycle** is used when the input is configured as a frequency input, **Set Point** is used when the input is configured as a high speed counter
		8	High Byte	

In Encoder mode, bytes 1 & 2 are the low word and bytes 3 & 4 are the high word to display a 32 bit value of the encoder count, 32 bit signed maximum positive count is 2,147,483,647.

| MODULE STATUS

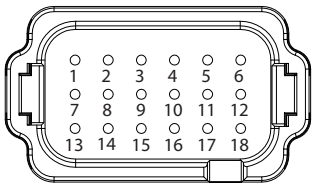
Status Message 1 (Software and Node Status)					
PGN	**Name**	**Data Type**	**Byte**	**Bits**	**Description**
(0xEF(CSA))*	Software Version	Byte	1		Version of the current software
	Software Revision		2		Revision of the current software
	Status 1	2 Bit	3	1,2	Factory Default Configuration
	Status 2			3,4	Configuration Saved (module is configured)
	Status 3			5,6	Alternate Configuration Received
	Status 4			7,8	Node Alive
	Status 5		4	1,2	Node Fault Present
	Status 6			3,4	Fault Count not Zero
	Status 7			5,6	
	Status 8			7,8	
	Fault Code	Byte	5		Active fault code
	User ID		6		The User ID of the module configured in CTRL1 message
	Status 9	2 Bit	7	1,2	True when Message Command = 0x52 received
	Status 10			3,4	True when Message Command = 0x53 received
	Status 11			5,6	True when Message Command = 0x54 received
	Status 12			7,8	True when Message Command = 0x55 received
	Status 13		8	1,2	True when Message Command = 0x56 received
	Status 14			3,4	True when Message Command = 0x57 received
	Hardware Version	4 Bit		5,6,7,8	Version of the current hardware

* (0xEF(Controller Source Address))
This is the only PGN that uses the controller source address as it is a reply to the controller.

Status Message 2 (Configuration and Output Status)					
PGN	**Name**	**Data Type**	**Byte**	**Bits**	**Description**
65531 (0xFFFB)	Config Pair 1	2 Bit	1	1,2	Baud rate configuration jumper is applied
	Config Pair 2			3,4	Node ID 1's configuration jumper is applied
	Config Pair 3			5,6	Node ID 2's configuration jumper is applied
	Config Pair 4			7,8	Node ID 3's configuration jumper is applied
	Config Pair 5		2	1,2	Node ID 4's configuration jumper is applied
				3,4	Not used, will see (11b)
				5,6	
				7,8	
	Output 1A Status		3	1,2	Status of Output 1A, (00 = off), (01 = on), (10 = fault)
	Output 1B Status			3,4	Status of Output 1B, (00 = off), (01 = on), (10 = fault)
	Output 2A Status			5,6	Status of Output 2A, (00 = off), (01 = on), (10 = fault)
	Output 2B Status			7,8	Status of Output 2B, (00 = off), (01 = on), (10 = fault)
	Output 3A Status		4	1,2	Status of Output 3A, (00 = off), (01 = on), (10 = fault)
	Output 3B Status			3,4	Status of Output 3B, (00 = off), (01 = on), (10 = fault)
	Output 4A Status			5,6	Status of Output 4A, (00 = off), (01 = on), (10 = fault)
	Output 4B Status			7,8	Status of Output 4B, (00 = off), (01 = on), (10 = fault)
			5	1,2	Not used, will see (11b)
				3,4	
				5,6	
				7,8	
			6	1,2	
				3,4	
				5,6	
				7,8	
	Power Buss P1	2 Bit	7	1,2	Status of Power Buss P1 (00 = off), (01 = on), (10 = fault)
	Power Buss P2			3,4	Status of Power Buss P2 (00 = off), (01 = on), (10 = fault)
				5,6	Not used, will see (11b)
				7,8	
	Save Config Counter	Byte	8		Count of how many times the configuration has been saved to the module

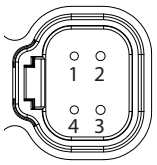
Status Message 3 (Controler Information)					
PGN	**Name**	**Data Type**	**Byte**	**Bits**	**Description**
65532 (0xFFFC)	AN1	10 Bit	1	All	Hardware Configuration
			2	1, 2	
	AN2		3	All	Battery Voltage (28mV per bit)
			4	1, 2	
	AN3		5	All	Module Temp (0 = 0°C, .25°C per bit)
			6	1, 2	
	AN4		7	All	Not used
			8	1, 2	Fault Count not Zero

Configuration & Power Plug



See page 33 for pinout guide

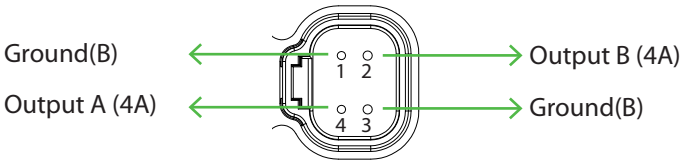
CAN Ports 1 & 2 Non-Isolated



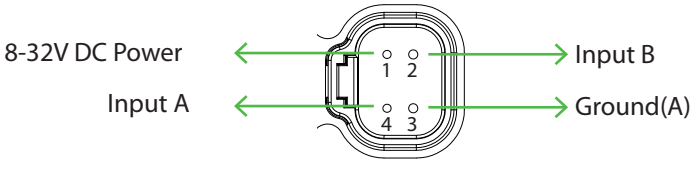
CAN
(J1939)
Pin 2 = CAN High
Pin 4 = CAN Low

Power
(Module & Input-13A)
Pin 1 = 8-32V DC
Pin 3 = Ground (A)

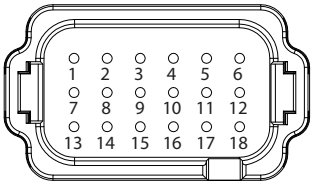
Outputs (Ports 1-4)



Inputs (Ports 5-8)



Configuration & Power Plug Pinouts



1. Baud1-A
2. Config 1-A
3. Config 2-A
4. Config 3-A
5. Config 4-A
6. N/C
7. Baud1-B
8. Config 1-B
9. Config 2-B
10. Config 3-B
11. Config 4-B
12. N/C
13. Power 1
14. Power 2
15. N/C
16. Ground (B)
17. Ground (B)
18. N/C

Baud Rate
No Jumper = 250kb
Baud1-A to Baud1-B = 500kb7.

Node ID (0-15)
Config1-A to Config1-B = 1s
Config2-A to Config2-B = 2s
Config3-A to Config3-B = 4s
Config4-A to Config4-B = 8s

Power (Output Only)
Power 1 = 13A for ports 1 & 2 (Outputs 1A, 1B, 2A, 2B)
Power 2 = 13A for ports 3 & 4 (Outputs 3A, 3B, 4A, 4B)
Ground 1B = for ports 1 - 4
Ground 2B = for ports 1 - 4

Outputs (Ports 1-4)

Power
Pin 1 = Ground B
Pin 3 = Ground B

Configurations
1. Digital high side
2. PWM
3. PWM (I) Current Controlled

Amperage
All outputs = 4A

Outputs
- Port 1, Pin 4: Output 1A
- Port 1, Pin 2: Output 1B

- Port 2, Pin 4: Output 2A
- Port 2, Pin 2: Output 2B

- Port 3, Pin 4: Output 3A
- Port 3, Pin 2: Output 3B

- Port 4, Pin 4: Output 4A
- Port 4, Pin 2: Output 4B

Inputs (Ports 5-8)

Power
Pin 1 = 8-32V DC
Pin 3 = Ground A

Configurations
Input A
1. Digital Positive
2. Digital Ground
3. Frequency/Counter/Encoder (7A & 8A)

Input B
1. Digital Positive
2. Digital Ground
3. 4-20mA
4. 0-5V DC
5. 0-10V DC
6. 0-32V DC
7. Ratiometric

Inputs
- Port 5, Pin 4: Input 5A
- Port 5, Pin 2: Input 5B

- Port 6, Pin 4: Input 6A
- Port 6, Pin 2: Input 6B

- Port 7, Pin 4: Input 7A
- Port 7, Pin 2: Input 7B

- Port 8, Pin 4: Input 8A
- Port 8, Pin 2: Input 8B

| TECHNICAL DATA

Art. No. / Description	DP-34044-1 / Combo Block
Dimension	3.802" x 10.427"
Installation	(3) M5 x 1 screws
Communication	2 non-isolated J1939 ports (250kb & 500kb)
Voltage Range	8-32V DC
Operating Temperature	(-40 to 85°C)
Storage Temperature	(-45 to 85°C)
Protection	IP67
Number of Ports	8
Total Number of I/O	16
Total Number of Inputs	8
Number of Digital	4 to 8*
Number of Config. Inputs	4 Digital, 4 Analog/Digital
Digital Input Configurations	Digital Positive, Digital Ground, Frequency/Counter/Encoder
Analog Input Configurations	0-10V DC, 0-5V DC, 0-32V DC, 4-20ma, Digital Ground, Digital Positive, Ratiometric
Analog Resolution	12 bit, 1% Full scale accuracy
Input Diagnostics	short circuit
Total Number of Outputs	8
Number of Config. Outputs	8
Output Configurations	n/a
PWM Frequency	Digital (+), PWM, PWM(I),
Output Diagnostics	100-1200hz
Switching Current	Short Circuit and Overcurrent
Total Output Current	4A
J1939 Port	26A
Node ID	0-15
Baud Rate	250 Kbits/s, 500 Kbits/s
LEDs	(4)blue (PWR), (2) red CAN, (16) yellow status
Ports 1-4	1=gnd, 2=sig 2, 3=gnd, 4=sig 1
Ports 5-8	1=+V DC, 2=sig 2, 3=gnd, 4=sig 1

Port Deutsch Plugs Needed	
Power Port Connector	DT16-18SA-K004
CAN & I/O Port Connector	DT06-4S
Wedgelock DT Series 4-pin Socket	W4S
Size 16, Solid Socket, 16 - 20 AWG	0462-201-16141
Size 16, Solid Socket, 14 AWG	0462-209-16141
Size 16, Locking Sealing Plug	0413-217-1605

| MESSAGE STRUCTURE

All PGNs are shown as module configured with no jumpers (Offset = 0)

PGN
61408 (0xEFE0) ***Node offset of 0***
Source Address
209 (0xD1)
PDU Format
239 (0xEF)
PDU Specific
224 (0xE0)
Built Message
(0x18EFE0D1)

Transmit rate
50 ms
Msg timeout
200 ms
Priority
24 (0x18)

Value
82 (0x52)

J1939 Output Configuration 1

Name	Data Type	Byte	Bits	Description
Command	Byte	1		Command for index pointer (which message you're sending)
Ctrl Mode Reset	2 bit	2	1,2	Enables Controller Mode Output Reset
Enable Status 1 Msg			3,4	Enables the constant transmission of status message 1
Enable Status 2 Msg			5,6	Enables the constant transmission of status message 2
Enable Amp Msg			7,8	Enables the constant transmission of amperage messages
Enable 24 vdc		3	1,2	Enables the low and over voltage fault limits for 24V DC system
Save Configura-tion			3,4	Saves the configuration to the module (otherwise changes only valid until a power cycle occurs), set to 1 to write configuration to module
			5,6	
			7,8	
		4	1,2	
			3,4	
			5,6	
			7,8	
FREQ1	Word	5	1,2	Sets the configuration of the frequency for all channels (30-1140 Hz)
		6	3,4	
MODE1	4 Bit	7	5,6	Sets the configuration of ALL the outputs, overides Command 53 and 54. (0=Mode 1 Not Used, 1=ON/OFF, 2=Data 0-4000, 3= Percent 0-100.0%(0-1000), **4= Amps (0-4000ma) Can't be used in this mode.**
MODE2		7	7,8	Sets the configuration of the inputs.(0=Mode 2 Not Used, 1=Digital Positive, 2=Digital Ground) **No analog**
ID1	Byte	8		User defined byte for configuration ID, this will be transimitted in the STAT message.

J1939 Output Control - Control Message 1 (Output Control)

Value
81 (0x51)

Name	Data Type	Byte	Bits	Description
Command	Byte	1		Command for index pointer (which message your sending)
Output1A	2 bit	2	1,2	Turns the output on when in "On/Off" Mode, (not used when using any other mode)
Output1B			3,4	
Output2A			5,6	
Output2B			7,8	
Output3A		3	1,2	
Output3B			3,4	
Output4A			5,6	
Output4B			7,8	
Output5A		4	1,2	Not used on this module
Output5B			3,4	
Output6A			5,6	
Output6B			7,8	
Output7A		5	1,2	
Output7B			3,4	
Output8A			5,6	
Output8B			7,8	
Not Used		6	1,2	
			3,4	
			5,6	
			7,8	
Input Power Port5		7	1,2	Enable for Port 5 Input Power, (00 = off), (01 = on)
Input Power Port6			3,4	Enable for Port 6 Input Power, (00 = off), (01 = on)
Input Power Port7			5,6	Enable for Port 7 Input Power, (00 = off), (01 = on)
Input Power Port8			7,8	Enable for Port 8 Input Power, (00 = off), (01 = on)
Not Used	Byte	8		

J1939 Output Configuration 2

Value
83 (0x53)

Name	Data Type	Byte	Bits	Description
Command	Byte	1		Command for index pointer (which message you're sending)
OUTMODE1A	4 bit	2	1,2,3,4	Mode **0x0=disabled, 0x1=On/Off, 0x2=Data(0-4000), 0x3=Percent(0-1000 = 0-100.0%), 0x4=Amps(0-4000 = 0-4.000A)**
OUTMODE1B			5,6,7,8	
OUTMODE2A		3	1,2,3,4	
OUTMODE2B			5,6,7,8	
OUTMODE3A		4	1,2,3,4	
OUTMODE3B			5,6,7,8	
OUTMODE4A		5	1,2,3,4	
OUTMODE4B			5,6,7,8	
INMODE5A		6	1,2,3,4	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground**
INMODE5B			5,6,7,8	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x3= 4-20ma (4000-20000), 0x4= 0-5V DC (0-5000), 0x5= 0-10V DC (0-10000), 0x6= 0-32V DC(0-32000), 0x9= Ratiometric (0-100.0% of source V DC)**
INMODE6A		7	1,2,3,4	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground**
INMODE6B			5,6,7,8	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x3= 4-20ma (4000-20000), 0x4= 0-5V DC (0-5000), 0x5= 0-10V DC (0-10000), 0x6= 0-32V DC(0-32000), 0x9= Ratiometric (0-100.0% of source V DC)**
INMODE7A		8	1,2,3,4	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x7=Digital Positive Frequency, 0x8= High Speed Counter, 0xA=Encoder**
INMODE7B			5,6,7,8	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x3= 4-20ma (4000-20000), 0x4= 0-5V DC (0-5000), 0x5= 0-10V DC (0-10000), 0x6= 0-32V DC(0-32000), 0x9= Ratiometric (0-100.0% of source V DC)**

J1939 Output Configuration 3

Value
84 (0x54)

Name	Data Type	Byte	Bits	Description
Command	Byte	1		Command for index pointer (which message you're sending)
INMODE8A	4 bit	2	1,2,3,4	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x7=Digital Positive Frequency, 0x8= High Speed Counter**
INMODE8B			5,6,7,8	Mode **0x0=disabled, 0x1=Digital Positive, 0x2=Digital Ground, 0x3= 4-20ma (4000-20000), 0x4= 0-5V DC (0-5000), 0x5= 0-10V DC (0-10000), 0x6= 0-32V DC(0-32000), 0x9= Ratiometric (0-100.0% of source V DC)**
Port 1A Kp	Byte	3		Output 1A proportional set point (0-250 = 0-2.50, >250=0) **default 100**
Port 1A Ki		4		Output 1A integral set point (0-250 = 0-2.50, >250=0) **default 100**
Port 1B Kp		5		Output 1B proportional set point (0-250 = 0-2.50, >250=0) **default 100**
Port 1B Ki		6		Output 1B integral set point (0-250 = 0-2.50, >250=0) **default 100**
Port 2A Kp		7		Output 2A proportional set point (0-250 = 0-2.50, >250=0) **default 100**
Port 2A Ki		8		Output 2A integral set point (0-250 = 0-2.50, >250=0) **default 100**

***Encoder mode, both 7A and 8A are used for the encoder input. When changing 7A to encoder it automatically sets up 8A to work with it.

J1939 Output Configuration 4

Value
85 (0x55)

Name	Data Type	Byte	Bits	Description
Command	Byte	1		Command for index pointer (which message you're sending)
Port 2B Kp		2		Output 2B proportional set point (0-250 = 0-2.50, >250=0) **default 100**
Port 2B Ki		3		Output 2B integral set point (0-250 = 0-2.50, >250=0) **default 100**
Port 3A Kp		4		Output 3A proportional set point (0-250 = 0-2.50, >250=0) **default 100**
Port 3A Ki		5		Output 3A integral set point (0-250 = 0-2.50, >250=0) **default 100**
Port 3B Kp		6		Output 3B proportional set point (0-250 = 0-2.50, >250=0) **default 100**
Port 3B Ki		7		Output 3B integral set point (0-250 = 0-2.50, >250=0) **default 100**
Not used		8		

J1939 Output Configuration 5

Value
86 (0x56)

Name	Data Type	Byte	Bits	Description
Command	Byte	1		Command for index pointer (which message you're sending)
Port 4A Kp		2		Output 4A proportional set point (0-250 = 0-2.50, >250=0) **default 100**
Port 4A Ki		3		Output 4A integral set point (0-250 = 0-2.50, >250=0) **default 100**
Port 4B Kp		4		Output 4B proportional set point (0-250 = 0-2.50, >250=0) **default 100**
Port 4B Ki		5		Output 4B integral set point (0-250 = 0-2.50, >250=0) **default 100**
Not used		6		
Not used		7		
Not used		8		

J1939 Counter Configuration Message

PGN
61408 (0xEFE0)
Source Address
224 (0xE0)
PDU Format
239 (0xEF)
PDU Specific
224 (0xE0)
Built Message
0x18EFE0E0)

Transmit rate
50 ms
Msg timeout
n/a
Priority
24 (0x18)

Value
87 (0x57)

Name	Data Type	Byte	Bits	Description
Command	Byte	1		Command for index pointer (which message you're sending)
Counter 7A On/Off	2 bit	2	1,2	Enable Counter 7A, 00 = Off, 01 = On (used in encoder mode)
Counter 7A Reset			3,4	Reset Counter 7A, 00 = Off, 01 = On (used in encoder mode)
Counter 7A Roll-Over Enabled			5,6	Enable Counter 7A Rollover, count continues after set point is achieved, 00 = Off, 01 = On (not used in encoder mode)
Counter 7A Enable Out 3A			7,8	Enable Output 3A when Counter 7A is enabled and set point hasn't been reached, 00 = Off, 01 = On (not used in encoder mode)
Counter 8A On/Off		3	1,2	Enable Counter 8A, 00 = Off, 01 = On (not used in encoder mode)
Counter 8A Reset			3,4	Reset Counter 8A, 00 = Off, 01 = On (not used in encoder mode)
Counter 8A Roll-Over Enabled			5,6	Enable Counter 8A Rollover, count continues after set point is achieved, 00 = Off, 01 = On (not used in encoder mode)
Counter 8A Enable Out 4A			7,8	Enable Output 4A when Counter 8A is enabled and set point hasn't been reached, 00 = Off, 01 = On (not used in encoder mode)
Spare		4	1,2	Not used on this module
			3,4	
			5,6	
			7,8	
Counter 7A Set Point	Word	5		Set point for totalalized count on Counter 7A
		6		
Counter 8A Set Point	Word	7		Set point for totalalized count on Counter 8A
		8		

Control Message 2 (PWM1)

PGN
65308 (0xFF1C)
Source Address
209 (0xD1)
PDU Format
255 (0xFF)
PDU Specific
28 (0x1C)
Built Message
(0x18FF1CD1)

Transmit rate
50 ms
Msg timeout
200 ms
Priority
24 (0x18)

Name	Data Type	Byte	Bits	Description
PWM Ctrl Output 1A	12 Bit	1	All	PWM Output 1A (12 bit, uses the 1st byte and the first 4 bits of the 2nd byte)
		2	1, 2, 3, 4	
PWM Ctrl Output 1B	12 Bit	3	All	PWM Output 1B (12 bit, uses the 1st byte and the first 4 bits of the 2nd byte)
		4	1, 2, 3, 4	
PWM Ctrl Output 2A	12 Bit	5	All	PWM Output 2A (12 bit, uses the 1st byte and the first 4 bits of the 2nd byte)
		6	1, 2, 3, 4	
PWM Ctrl Output 2B	12 Bit	7	All	PWM Output 2B (12 bit, uses the 1st byte and the first 4 bits of the 2nd byte)
		8	1, 2, 3, 4	

Control Message 3 (PWM2)

PGN
65309 (0xFF1D)
Source Address
209 (0xD1)
PDU Format
255 (0xFF)
PDU Specific
29 (0x1D)
Built Message
(0x18FF1DD1)

Transmit rate
50 ms
Msg timeout
200 ms
Priority
24 (0x18)

Name	Data Type	Byte	Bits	Description
PWM Ctrl Output 3A	12 Bit	1	All	PWM Output 3A (12 bit, uses the 1st byte and the first 4 bits of the 2nd byte)
		2	1, 2, 3, 4	
PWM Ctrl Output 3B	12 Bit	3	All	PWM Output 3B (12 bit, uses the 1st byte and the first 4 bits of the 2nd byte)
		4	1, 2, 3, 4	
PWM Ctrl Output 4A	12 Bit	5	All	PWM Output 4A (12 bit, uses the 1st byte and the first 4 bits of the 2nd byte)
		6	1, 2, 3, 4	
PWM Ctrl Output 4B	12 Bit	7	All	PWM Output 4B (12 bit, uses the 1st byte and the first 4 bits of the 2nd byte)
		8	1, 2, 3, 4	

J1939 Digital Status

PGN
65301 (0xFF15) E0=SA
Source Address
224 (0xE0)
PDU Format
255 (0xFF)
PDU Specific
21 (0x15)
Built Message
(0x18FF15E0)

Transmit rate
50 ms
Msg timeout
200 ms
Priority
24 (0x18)

Name	Data Type	Byte	Bits	Description
Input1A	2 bit	1	1,2	Not Used
Input1B			3,4	
Input2A			5,6	
Input2B			7,8	
Input3A		2	1,2	
Input3B			3,4	
Input4A			5,6	
Input4B			7,8	
Input5A		3	1,2	00 = Off, 01 = On, 10 = Fault
Input5B			3,4	
Input6A			5,6	
Input6B			7,8	
Input7A		4	1,2	
Input7B			3,4	
Input8A			5,6	
Input8B			7,8	
Not used	Byte	5		
		6		
		7		
		8		

J1939 Analog Status 1

PGN
65304 (0xFF18)
Source Address
224 (0xE0)
PDU Format
255 (0xFF)
PDU Specific
24 (0x18)
Built Message
(0x18FF18E0)

Transmit rate
50 ms
Msg timeout
200 ms
Priority
24 (0x18)

Name	Data Type	Byte	Bits	Description
Analog Input 5A	Word	1	Low Byte	**Not Used on this module, discrete only**
		2	High Byte	
Analog Input 5B	Word	3	Low Byte	Analog Input 5B, (4-20ma = 4,000 - 20,000) (0-5V DC = 0 - 5,000mv) (0-10V DC = 0-10,000mv) (0-32V DC = 0 - 32,000mv) (Ratiometric = 0 - 100.0% of source voltage)
		4	High Byte	
Analog Input 6A	Word	5	Low Byte	**Not Used on this module, discrete only**
		6	High Byte	
Analog Input 6B	Word	7	Low Byte	Analog Input 6B, (4-20ma = 4,000 - 20,000) (0-5V DC = 0 - 5,000mv) (0-10V DC = 0-10,000mv) (0-32V DC = 0 - 32,000mv) (Ratiometric = 0 - 100.0% of source voltage)
		8	High Byte	

J1939 Analog Status 2

PGN
65305 (0xFF19)
Source Address
224 (0xE0)
PDU Format
255 (0xFF)
PDU Specific
25 (0x19)
Built Message
(0x18FF19E0)

Transmit rate
50 ms
Msg timeout
200 ms
Priority
24 (0x18)

Name	Data Type	Byte	Bits	Description
Analog Input 7A	Word	1	Low Byte	**Not Used on this module, discrete only**
		2	High Byte	
Analog Input 7B	Word	3	Low Byte	Analog Input 7B, (4-20ma = 4,000 - 20,000) (0-5V DC = 0 - 5,000mv) (0-10V DC = 0-10,000mv) (0-32V DC = 0 - 32,000mv) (Ratiometric = 0 - 100.0% of source voltage)
		4	High Byte	
Analog Input 8A	Word	5	Low Byte	**Not Used on this module, discrete only**
		6	High Byte	
Analog Input 8B	Word	7	Low Byte	Analog Input 8B, (4-20ma = 4,000 - 20,000) (0-5V DC = 0 - 5,000mv) (0-10V DC = 0-10,000mv) (0-32V DC = 0 - 32,000mv) (Ratiometric = 0 - 100.0% of source voltage)
		8	High Byte	

J1939 Frequency Status

PGN
65307 (0xFF1B)
Source Address
224 (0xE0)
PDU Format
255 (0xFF)
PDU Specific
27 (0x1B)
Built Message
(0x18FF1BE0)

Transmit rate
50 ms
Msg timeout
n/a
Priority
24 (0x18)

Name	Data Type	Byte	Bits	Description
Hertz_Count Input 7A	Word	1	Low Byte	Input 7A, **Hertz** is used when the input is configured as a frequency input, **Count** is used when the input is configured as a high speed counter
		2	High Byte	
Duty Cycle_ SP Input 7A	Word	3	Low Byte	Input 7A, **Duty Cycle** is used when the input is configured as a frequency input, **Set Point** is used when the input is configured as a high speed counter
		4	High Byte	
Hertz_Count Input 8A	Word	5	Low Byte	Input 8A, **Hertz** is used when the input is configured as a frequency input, **Count** is used when the input is configured as a high speed counter
		6	High Byte	
Duty Cycle_SP Input 8A	Word	7	Low Byte	Input 8A, **Duty Cycle** is used when the input is configured as a frequency input, **Set Point** is used when the input is configured as a high speed counter
		8	High Byte	

****In encoder mode, bytes 1&2 are the low word and bytes 3&4 are the high word*****

STATUS MESSAGES

Status Message 1 (Software and Node Status)

PGN
(0xEF(Controller Source Address))
Source Address
224 (0xE0)
PDU Format
239 (0xEF)
PDU Specific
(0xController Source Address)
Built Message
(0x18EF??E0)

Transmit rate
50 ms
Msg timeout
200 ms
Priority
24 (0x18)

Name	Data Type	Byte	Bits	Description
Software Version	Byte	1		Version of the current software
Software Revision		2		Revision of the current software
Status 1	2 Bit	3	1,2	Factory Default Configuration
Status 2			3,4	Configuration Saved (module is configured)
Status 3			5,6	Alternate Configuration Received
Status 4			7,8	Node Alive
Status 5		4	1,2	Node Fault Present
Status 6			3,4	Fault Count not Zero
Status 7			5,6	Not used, will see (11b)
Status 8			7,8	
Fault Code	Byte	5		Active fault code
User ID		6		The User ID of the module configured in CTRL1 message
Status 9	2 Bit	7	1,2	True when Message Command = 0x52 received
Status 10			3,4	True when Message Command = 0x53 received
Status 11			5,6	True when Message Command = 0x54 received
Status 12			7,8	True when Message Command = 0x55 received
Status 13		8	1,2	True when Message Command = 0x56 received
Status 14			3,4	True when Message Command = 0x57 received
Hardware Version	4 Bit		5,6,7,8	Version of the current hardware

Status Message 2 (Configuration and Output Status)

PGN
65531 (0xFFFB)
Source Address
224 (0xE0)
PDU Format
255 (0xFF)
PDU Specific
251 (0xFB)
Built Message
(0x18FFFBE0)

Transmit rate
50 ms
Msg timeout
n/a
Priority
24 (0x18)

Name	Data Type	Byte	Bits	Description
Config Pair 1	2 Bit	1	1,2	Baud rate configuration jumper is applied
Config Pair 2			3,4	Node ID 1's configuration jumper is applied
Config Pair 3			5,6	Node ID 2's configuration jumper is applied
Config Pair 4			7,8	Node ID 3's configuration jumper is applied
Config Pair 5		2	1,2	Node ID 4's configuration jumper is applied
			3,4	Not used, will see (11b)
			5,6	
			7,8	
Output 1A Status		3	1,2	Status of Output 1A, (00 = off), (01 = on), (10 = fault)
Output 1B Status			3,4	Status of Output 1B, (00 = off), (01 = on), (10 = fault)
Output 2A Status			5,6	Status of Output 2A, (00 = off), (01 = on), (10 = fault)
Output 2B Status			7,8	Status of Output 2B, (00 = off), (01 = on), (10 = fault)
Output 3A Status		4	1,2	Status of Output 3A, (00 = off), (01 = on), (10 = fault)
Output 3B Status			3,4	Status of Output 3B, (00 = off), (01 = on), (10 = fault)
Output 4A Status			5,6	Status of Output 4A, (00 = off), (01 = on), (10 = fault)
Output 4B Status			7,8	Status of Output 4B, (00 = off), (01 = on), (10 = fault)
Input Power Port 5		5	1,2	Status of output for Input Power on Port 5, (00 = off), (01 = on), (10 = fault)
			3,4	Not used, will see (11b)
Input Power Port 6			5,6	Status of output for Input Power on Port 6, (00 = off), (01 = on), (10 = fault)
			7,8	Not used, will see (11b)
Input Power Port 7		6	1,2	Status of output for Input Power on Port 7, (00 = off), (01 = on), (10 = fault)
			3,4	Not used, will see (11b)
Input Power Port 8			5,6	Status of output for Input Power on Port 8, (00 = off), (01 = on), (10 = fault)
			7,8	Not used, will see (11b)
Power Buss P1		7	1,2	Status of Power Buss P1 (00 = off), (01 = on), (10 = fault)
Power Buss P2			3,4	Status of Power Buss P2 (00 = off), (01 = on), (10 = fault)
Power Buss P3			5,6	Not used, will see (11b)
Power Buss P4			7,8	
Save Config Counter	Byte	8		Count of how many times the configuration has been saved to the module

Status Message 3 (Controller Information)

PGN
65532 (0xFFFC)
Source Address
224 (0xE0)
PDU Format
255 (0xFF)
PDU Specific
252 (0xFC)
Built Message
(0x18FFFCE0)

Transmit rate
50 ms
Msg timeout
n/a
Priority
24 (0x18)

Name	Data Type	Byte	Bits	Description
AN1	10 Bit	1	All	Hardware Configuration
		2	1, 2	
AN2	10 Bit	3	All	Battery Voltage (28mV per bit)
		4	1, 2	
AN3	10 Bit	5	All	Module Temp (0 = 0°C, .25°C per bit)
		6	1, 2	
AN4	10 Bit	7	All	Not used
		8	1, 2	

Status Message 4 (Output Amperage Feedback OUT 1A-2B)

PGN
65523 (0xFFF3)
Source Address
224 (0xE0)
PDU Format
255 (0xFF)
PDU Specific
243 (0xF3)
Built Message
(0x18FFF3E0)

Transmit rate
50 ms
Msg timeout
200ms
Priority
24 (0x18)

Name	Data Type	Byte	Bits	Description
OUT 1A AMP FEEDBACK	Word	1		Current reading on Output 1A, 0-4000 mA
		2		
OUT 1B AMP FEEDBACK	Word	3		Current reading on Output 1B, 0-4000 mA
		4		
OUT 2A AMP FEEDBACK	Word	5		Current reading on Output 2A, 0-4000 mA
		6		
OUT 2B AMP FEEDBACK	Word	7		Current reading on Output 2B, 0-4000 mA
		8		

Status Message 4 (Output Amperage Feedback OUT 3A-4B)

PGN
65524 (0xFFF4)
Source Address
224 (0xE0)
PDU Format
255 (0xFF)
PDU Specific
243 (0xF4)
Built Message
(0x18FFF4E0)

Transmit rate
50 ms
Msg timeout
200ms
Priority
24 (0x18)

Name	Data Type	Byte	Bits	Description
OUT 3A AMP FEEDBACK	Word	1		Current reading on Output 3A, 0-4000 mA
		2		
OUT 3B AMP FEEDBACK	Word	3		Current reading on Output 3B, 0-4000 mA
		4		
OUT 4A AMP FEEDBACK	Word	5		Current reading on Output 4A, 0-4000 mA
		6		
OUT 4B AMP FEEDBACK	Word	7		Current reading on Output 4B, 0-4000 mA
		8		

| PGNs USED

Depending on the Node ID selected for the module, the PGNs and source address will be different for the module. The section below shows which are used for each Node ID.

Module	Control	PWM1	PWM2	Module Status	Digital Input Status	Analog Inputs 5A-6B	Analog Inputs 7A-8B	Freq. Inputs 7A-8A
0	EFE0	FF1C	FF1D	(EF(CSA)) (SA=E0)	FF15 (SA=E0)	FF18 (SA=E0)	FF19 (SA=E0)	FF1B (SA=E0)
1	EFE1	FF20	FF21	(EF(CSA)) (SA=E1)	FF15 (SA=E1)	FF18 (SA=E1)	FF19 (SA=E1)	FF1B (SA=E1)
2	EFE2	FF24	FF25	(EF(CSA)) (SA=E2)	FF15 (SA=E2)	FF18 (SA=E2)	FF19 (SA=E2)	FF1B (SA=E2)
3	EFE3	FF28	FF29	(EF(CSA)) (SA=E3)	FF15 (SA=E3)	FF18 (SA=E3)	FF19 (SA=E3)	FF1B (SA=E3)
4	EFE4	FF2C	FF2D	(EF(CSA)) (SA=E4)	FF15 (SA=E4)	FF18 (SA=E4)	FF19 (SA=E4)	FF1B (SA=E4)
5	EFE5	FF30	FF31	(EF(CSA)) (SA=E5)	FF15 (SA=E5)	FF18 (SA=E5)	FF19 (SA=E5)	FF1B (SA=E5)
6	EFE6	FF34	FF35	(EF(CSA)) (SA=E6)	FF15 (SA=E6)	FF18 (SA=E6)	FF19 (SA=E6)	FF1B (SA=E6)
7	EFE7	FF38	FF39	(EF(CSA)) (SA=E7)	FF15 (SA=E7)	FF18 (SA=E7)	FF19 (SA=E7)	FF1B (SA=E7)
8	EFE8	FF3C	FF3D	(EF(CSA)) (SA=E8)	FF15 (SA=E8)	FF18 (SA=E8)	FF19 (SA=E8)	FF1B (SA=E8)
9	EFE9	FF40	FF41	(EF(CSA)) (SA=E9)	FF15 (SA=E9)	FF18 (SA=E9)	FF19 (SA=E9)	FF1B (SA=E9)
10	EFEA	FF44	FF45	(EF(CSA)) (SA=EA)	FF15 (SA=EA)	FF18 (SA=EA)	FF19 (SA=EA)	FF1B (SA=EA)
11	EFEB	FF48	FF49	(EF(CSA)) (SA=EB)	FF15 (SA=EB)	FF18 (SA=EB)	FF19 (SA=EB)	FF1B (SA=EB)
12	EFEC	FF4C	FF4D	(EF(CSA)) (SA=EC)	FF15 (SA=EC)	FF18 (SA=EC)	FF19 (SA=EC)	FF1B (SA=EC)
13	EFED	FF50	FF51	(EF(CSA)) (SA=ED)	FF15 (SA=ED)	FF18 (SA=ED)	FF19 (SA=ED)	FF1B (SA=ED)
14	EFEE	FF54	FF55	(EF(CSA)) (SA=EE)	FF15 (SA=EE)	FF18 (SA=EE)	FF19 (SA=EE)	FF1B (SA=EE)
15	EFFF	FF58	FF59	(EF(CSA)) (SA=EF)	FF15 (SA=EF)	FF18 (SA=EF)	FF19 (SA=EF)	FF1B (SA=EF)

Module	Control	PWM1	PWM2	Output Status	Analog Status	Amp Data 1-4	Amp Data 5-8	Fault Count
0	EFE0	FF1C	FF1D	FFFB (SA=E0)	FFFC (SA=E0)	FFF3 (SA=E0)	FFF4 (SA=E0)	FFE6 (SA=E0)
1	EFE1	FF20	FF21	FFFB (SA=E1)	FFFC (SA=E1)	FFF3 (SA=E1)	FFF4 (SA=E1)	FFE6 (SA=E1)
2	EFE2	FF24	FF25	FFFB (SA=E2)	FFFC (SA=E2)	FFF3 (SA=E2)	FFF4 (SA=E2)	FFE6 (SA=E2)
3	EFE3	FF28	FF29	FFFB (SA=E3)	FFFC (SA=E3)	FFF3 (SA=E3)	FFF4 (SA=E3)	FFE6 (SA=E3)
4	EFE4	FF2C	FF2D	FFFB (SA=E4)	FFFC (SA=E4)	FFF3 (SA=E4)	FFF4 (SA=E4)	FFE6 (SA=E4)
5	EFE5	FF30	FF31	FFFB (SA=E5)	FFFC (SA=E5)	FFF3 (SA=E5)	FFF4 (SA=E5)	FFE6 (SA=E5)
6	EFE6	FF34	FF35	FFFB (SA=E6)	FFFC (SA=E6)	FFF3 (SA=E6)	FFF4 (SA=E6)	FFE6 (SA=E6)
7	EFE7	FF38	FF39	FFFB (SA=E7)	FFFC (SA=E7)	FFF3 (SA=E7)	FFF4 (SA=E7)	FFE6 (SA=E7)
8	EFE8	FF3C	FF3D	FFFB (SA=E8)	FFFC (SA=E8)	FFF3 (SA=E8)	FFF4 (SA=E8)	FFE6 (SA=E8)
9	EFE9	FF40	FF41	FFFB (SA=E9)	FFFC (SA=E9)	FFF3 (SA=E9)	FFF4 (SA=E9)	FFE6 (SA=E9)
10	EFEA	FF44	FF45	FFFB (SA=EA)	FFFC (SA=EA)	FFF3 (SA=EA)	FFF4 (SA=EA)	FFE6 (SA=EA)
11	EFEB	FF48	FF49	FFFB (SA=EB)	FFFC (SA=EB)	FFF3 (SA=EB)	FFF4 (SA=EB)	FFE6 (SA=EB)
12	EFEC	FF4C	FF4D	FFFB (SA=EC)	FFFC (SA=EC)	FFF3 (SA=EC)	FFF4 (SA=EC)	FFE6 (SA=EC)
13	EFED	FF50	FF51	FFFB (SA=ED)	FFFC (SA=ED)	FFF3 (SA=ED)	FFF4 (SA=ED)	FFE6 (SA=ED)
14	EFEE	FF54	FF55	FFFB (SA=EE)	FFFC (SA=EE)	FFF3 (SA=EE)	FFF4 (SA=EE)	FFE6 (SA=EE)
15	EFFF	FF58	FF59	FFFB (SA=EF)	FFFC (SA=EF)	FFF3 (SA=EF)	FFF4 (SA=EF)	FFE6 (SA=EF)

| FIRMWARE UPDATES

All modules are capable of in the field firmware updates with the use of the xtreme DB Programming Kit (DP-34005-12). DP Loader is the software used to download the firmware to the xtreme DB blocks. Please reference the DP Loader User Manual for instructions.

STW Technic, LP
Mobile Controllers and
Measurement Technologies

770-242-1002

DP34044-1 | 8.16 | US-xtremedb34044-1-2016