



ioBLOC

200A Output Module



Part Number
PN 100001293

Product Manual

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Features:

- For 12 or 24V Nominal Systems
- 25A for outputs 1-4 continuous, 15A for outputs 5-10, 190A max per unit
- Short circuit and overcurrent protection
- Short circuit limit of 100A for outputs 1-4, 43A for outputs 5-10 to allow for inrush currents
- Open load detection when diagnostic mode is enabled
- Programmable overcurrent limit
- 250kbps baud rate with J1939 protocol
- IP67 rated with properly mated connectors
- Load dump protection available up to 151V
- Jump start voltages up to 36VDC

Functional Requirements:

Electrical Requirements:

This unit receives logic power and switched battery from the two red 6GA power cables. Logic ground is received from pins 7 and 8 on the black 12 pin connector. Each power lead shall be fused externally at 100A max. All power is controlled via CAN interface. The ground path for each output load shall be run external to the unit.

Parameter	Min	Nominal	Max	Notes
Functional Battery Voltage	9VDC	28VDC	32VDC	Nominal 12/24VDC battery systems
Reverse Battery Voltage			-28VDC	One minute with max loads attached. No protection mechanism are available during reverse battery.
Max Output Current	-	-	190A	Max current for entire system, 10 outputs on. Each power lead should be fused externally at 100A max. See derating curve.
System Standby Current	-	25mA	30mA	Overall system current with all outputs off, input voltage in functional range.
Max Outputs 1-4 Current (On State)	-	-	25A	Continuous, surges up to 100A (nominal) allowed for less than 2 seconds
Output Leakage Current (Off State)	-	-	10uA	Per Channel, Current is shunted to ground via internal 100K pulldowns to allow for state measurement with a meter, and to prevent LED glow due to leakage current. 32VDC.
ESD Protection	-	-	15KV	All pins
CAN Bus Baud Rate	-	250Kbps	-	-
CAN ID	-	0x60	-	Default, can be changed via address inputs.

LEDs/Indication:

The green LED indicates that the module is powered and shall be illuminated any time power is to the module.

The red LED next to the green LED indicates that the module is communicating. A flashing red LED means there is good communication. If communications fails, the red LED will extinguish.

Each output has a corresponding LED that is directly connected to it. The brightness of the LEDs are controlled by the voltage, duty cycle, and frequency of its corresponding output.

Connectors/Pinout:

Battery Positive (+) Input:

Two 6AWG SGX power leads with Deutsch DTHD04-1-4P. Each to be individually fused at 100A.

Mating Connector: Deutsch DTHD06-1-4S, Mating Deutsch Contact: 0462-203-04141

Outputs 1-6 Connector:

Connector: Deutsch DTF15-12PA (Gray).

Mating Connector: Deutsch DT06-12SA, Mating Deutsch Contact: 0462-201-16141, Wedgeloock: W12S

Pinout:

Pin:	Function:
1, 12	Output 1
2, 11	Output 2
3, 10	Output 3
4, 9	Output 4
5, 8	Output 5
6, 7	Output 6

Outputs 7-10, Addressing Inputs, Logic Ground Connector:

Connector: Deutsch DTF15-12PB (Black)

Mating Connector: Deutsch DT06-12SB, Mating Deutsch Contact: 0462-201-16141, Wedgeloock: W12S

Pinout:

Pin:	Function:
1, 12	Output 7
2, 11	Output 8
3, 10	Output 9
4, 9	Output 10
5	Addressing Input 0 (Sinking Input - See Chart in "Operation of Unit")
6	Addressing Input 1 (Sinking Input - See Chart in "Operation of Unit")
7, 8	Ground

CAN Connector:

Connector: Deutsch DT04-3P

Mating Connector: DT06-3S, Contacts: 0462-201-16141, Wedgelock: W3S-1939

Pinout:

Pin:	Function:
A	CANH
B	CANL
C	Ground (CAN Shield)

Environmental Requirements:

Parameter	Min	Nominal	Max	Notes
Operating Temperature	-40C	-	85C	-
Storage Temperature	-40C	-	125C	-
Storage/Operating Humidity	0%	-	100%	Including Condensing
Ingress Protection	-	-	IP67	Protected Against Immersion up to 1m for 1hour. With all connectors properly mated and strain relieved.

Environmental/Mechanical Testing

Parameter	Test	Notes
Thermal Cycle Test*	SAE J1455 Section 4.1.3, 8-Hour Cycle	Unpowered, -40°C to 85°C, 20 cycles
Thermal Shock Test	ISO16750-4 Section 5.3. 2	Unpowered, -40°C to 85°C, 100 cycles, 60 min dwells
Drop Test / Handling Shock*	IEC 60068-2-31 Section 5.1, 5.2.	Topple, Free Fall 1m onto concrete
Humidity & Temperature Cycling (Thermal Cyclic Aging)*	SAE J1455 Section 4.2.3, Figure 4A, 8 Hour	Powered but not necessarily monitored for function. -40°C to 85°C, 50 cycles
Fluid Compatibility*	SAE J1455 Section 4. 4	Degreaser, DEF, Diesel, 10W-30 Motor Oil, Anti-Freeze
Thermal Shock Immersion*	ISO16750-4 Section 5.4.3	Unit brought to 85°C to then submerged in Ice Water, Salt, Detergent, Dye, Unpowered for dunk.
Ingress Protection (IP)*	IEC 60519, IP67	1m of Water, 30 minutes. Water and equipment temperature within 5°C of each other.

Mechanical Shock Test*	Half -sine – 50g	3 axis, 11ms pulse duration in positive and negative directions with 1 second between pulses
Vibration – Random*	Standard Trombetta random vibration profile. Overall GRMS- 8.17GRMS, 5-2000Hz	3 axis 8 hours per axes. Connectors populated.
Load Dump*	ISO16750-2, Section 4.6.4.2.2, SAE J1113-11, Pulse 5B, ISO7637 Pulse 5B	32VDC, 2 Ohm, 350ms, 5 pulses, 1 min intervals

*Testing performed on electrically and mechanically similar design. Lab results available upon request.

Operation of Units:

The unit runs on J1939 protocol. Once initialized and CAN communication has been established, the unit will allow control of the outputs via the CAN messaging structure outlined below. By default, if CAN communication is lost during operation, any outputs that are on will remain on. A message has been included that can change this setting such that the outputs will cascade off when CAN communication is lost. The unit will provide analog current feedback for each output, as well as a diagnostic state for each output.

Diagnostic states for outputs 1-4 is as follows:

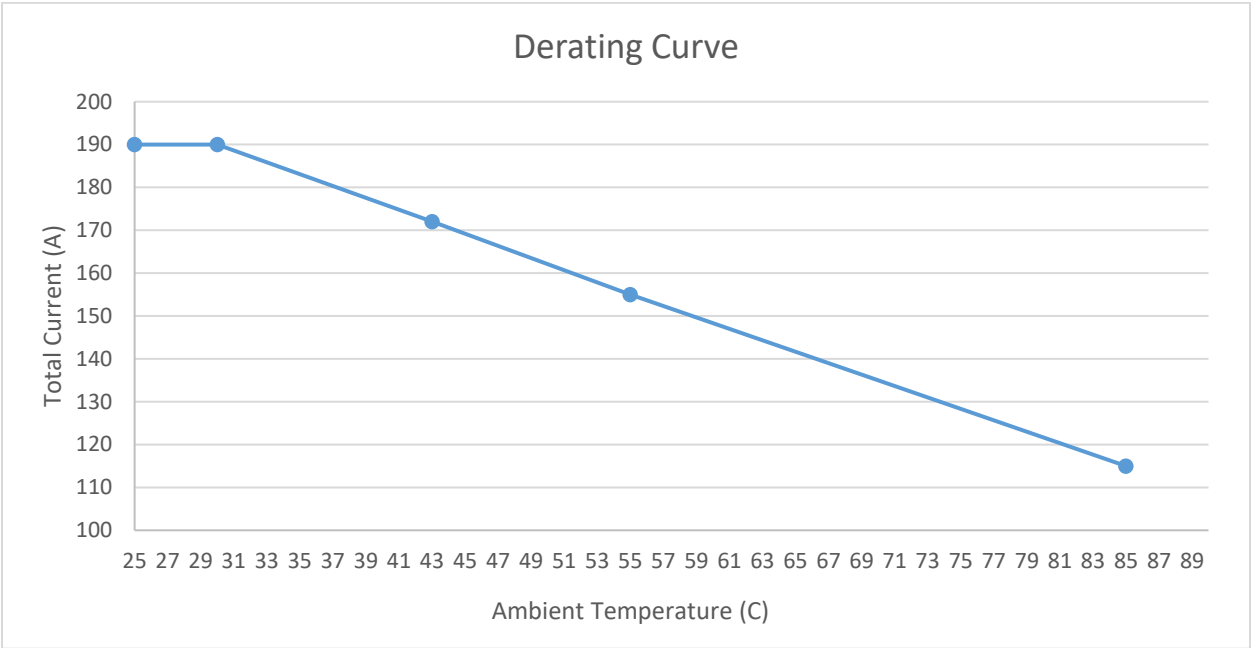
Diagnostics	Output State	Fault	Latch Off
Off	Output Off & No Fault	No	No
On	Output On & No Fault	No	No
Open/No Load	Output On & Current < 1A	Yes	No
Overcurrent	Current > 25A < 100A (for greater than 2 seconds)	Yes	Yes
Short Circuit/Self-Protect	Current > 100A or overtemperature	Yes	Yes

Diagnostic states for outputs 5-10 is as follows:

Diagnostics	Output State	Fault	Latch Off
Off	Output Off & No Fault	No	No
On	Output On & No Fault	No	No
Open/No Load	Output On & Current < 1A	Yes	No
Overcurrent	Current > 15A < 43A (for greater than 2 seconds)	Yes	Yes
Short Circuit/Self-Protect	Current > 43A or overtemperature	Yes	Yes

Any overcurrent or short circuit/self-protect fault will cause the output to latch off until it is reset by a power cycle or setting the faulted output’s duty cycle back to zero via CAN. A detection of an open/no load will only occur when the diagnostic mode is enabled and the output is on and will not be latched in the diagnostic until reset. An open/no load fault will neither cause the output to turn off if on, nor prevent an output that is off from turning on.

When in operational mode, the unit will constantly monitor the temperature of the output FETs via an analog thermistor. When the temperature reaches 120 degrees Celsius, all outputs will turn off and the CAN LED will flash at a rate of 2Hz. See below for the derating curve for continuous operation:



The unit can have its CAN ID modified via the addressing inputs in the black 12-pin connector. The CAN ID change takes effect only on power up. See chart below for input states and corresponding CAN ID.

ADDR0	ADDR1	CAN ID
HIGH	HIGH	0x60
LOW	HIGH	0x61
HIGH	LOW	0x62
LOW	LOW	0x63

Supported Messages:

Wake-up Message: Broadcast Message from Specified Module							
BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE 4	BYTE 5	BYTE 6	BYTE 7
Command	Month	Day	Year(MSB)	Year(LSB)	Major REV	Minor REV	Module Status
0x01	0x??	0x??	0x??	0x??	0x??	0x??	0x??
Byte 0	COMMAND	Command Byte – For Device Wake Up Response, the command byte is 0x01.					
Byte 1	MONTH	The month of the software version date in BCD format. e.g. for '12', MONTH = 0x12 = 18d					
Byte 2	DAY	The day of the software version date in BCD format. e.g. for '31', DAY = 0x31 = 49d					
Byte 3	YEAR (MSB)	The first two digits of the year of the software version date in BCD format. e.g. for '2006', YEAR (MSB) = 0x20 = 32d					
Byte 4	YEAR (LSB)	The last two digits of the year of the software version date in BCD format. e.g. for '2006', YEAR (LSB) = 0x06 = 6d					
Byte 5	MAJOR REV	The major revision number of the software version in decimal format. The major rev. must start at 1 and cannot exceed 9.					
Byte 6	MINOR REV	The minor revision number of the software version in decimal format.					
Byte 7	MODULE STATUS	Status: 0x00 = Needs Configuration 0x01 = Configuration OK 0x02 = Configuration Unknown (after initial power up or hard reset) 0x03 = High Temperature (Outputs will be off and heartbeat LED will flash faster) 0x04 = Not Used 0x05 = No Comm. 0x06 = Active Run Mode 0x07 = Reserved					

Commfail timeout Configuration: Point to point message from CONTROLLER to Specified Module							
BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE 4	BYTE 5	BYTE 6	BYTE 7
Command	My Time	Unused	Unused	Unused	Unused	Unused	Unused
0x10	0x??	0xFF	0xFF	0xFF	0xFF	0xFF	0xFF
My Time: If module does not get a message within this amount of time, it goes into commfail. (Value sent * 100msec). Default = 7 seconds, Maximum = 25.5 seconds.							

Reset any module: Point to point message from CONTROLLER to Specified Module							
BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE 4	BYTE 5	BYTE 6	BYTE 7
Command						Type	Unused
0x11	0x01	0xA5	0x5A	0x49	0x94	0x??	0xFF
The module shall transition to the Device Power-Up mode. Type: Soft = 0x00 Hard = 0x01 Soft: Module will start broadcasting wakeup message with whatever mode it is in, does not affect Input and/or Output Status Hard: All Inputs and/or Outputs are disabled (Off) and then the module will behave as if just powered up. The wake-up message(s) will be sent to the CONTROLLER so it can then configure all the I/Os.							

CONTROLLER Wake-up Message: Point to point message from CONTROLLER to Specified Module							
BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE 4	BYTE 5	BYTE 6	BYTE 7
Command	Vehicle Serial Number				Unused	Echo Runtime	Echo Configuration
0x12	0x??	0x??	0x??	0x??	0xFF	0x??	0x??
Vehicle Serial Number: Compared to saved vehicle serial for saved configuration. NOTE: The vehicle serial number cannot be all 0xFF or all 0x00. Echo Runtime: If enabled, specified runtime messages shall be repeated after runtime command is received 0x00 or 0xFF = echo disabled 0x01 = echo enabled Echo Configuration: If enabled, specified configuration messages shall be repeated after configuration command is received 0x00 or 0xFF = echo disabled 0x01 = echo enabled							

Save Configuration Message: Point to point message from CONTROLLER to Specified Module							
BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE 4	BYTE 5	BYTE 6	BYTE 7
Command	Vehicle Serial Number				Unused	Unused	Unused
0x13	0x??	0x??	0x??	0x??	0xFF	0xFF	0xFF
Serial Number: Serial number that is saved. Used to compare against wake up message serial number. Note: Configuration values of specified messages shall be saved to non-volatile memory upon receipt of the save configuration message 0x13 from the controller							

Output Configuration Message 1: Point to Point Message from CONTROLLER to Specified Power Module							
This message is required for each configured output							
BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE 4	BYTE 5	BYTE 6	BYTE 7
Command	Output Number	Mode / Slew Type	PWM Frequency	Amperage Limit	Amperage Delay Time	ON Slew Rate	OFF Slew Rate
0x60	0x??	0x??	0x??	0x??	0x??	0x??	0x??
Output Number: The output number that is being configured Output Numbering will be 0 to 7 Mode / Slew Type: The high nibble is for mode, the low nibble is slew type. Mode: 0 = Disabled (default) 1 = PWM Slew Type: 0 = Linear (default)							
PWM Frequency: The frequency rate for the PWM output. (Value is 32 to 255 Hz) Amperage Limit: The current set point for over current condition. Outputs 5-10 are capped at 15A.(Value is 1/10 of amp) Amperage Delay Time: Delay for current limit. (Value sent * 10 msec) ON Slew Rate: The rate in which to ramp to ON value. (Value sent * 10 msec) OFF Slew Rate: The rate in which to ramp to OFF value. (Value sent * 10 msec)							
Note: Configuration values shall be saved to non-volatile memory upon receipt of the save configuration message 0x13 from the controller. If 0x13 is not sent on that power-cycle, the configuration values shall revert to the last saved configuration upon the next power cycle							
Note: This message shall be returned from the specified module to the Controller upon receipt of this message and when configured by the Echo Configuration byte of message 0x12 by the specified module. This acts as an "echo" confirmation of the proper configuration.							

Output Runtime Data 1: Point to Point Message from CONTROLLER to Specified Power Module

BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE 4	BYTE 5	BYTE 6	BYTE 7
Command	Subset	Not Used	Output 3 + Offset	Output 2 + Offset	Output 1 + Offset	Output 0 + Offset	Unused
0x65	0x??	0x00	0x??	0x??	0x??	0x??	0xFF

This message is used to control the output PWM duty cycle for outputs

Subset:

0x00 = outputs 0-3

0x01 = outputs 4-7

If any subset received is greater than 0x01, the entire message shall be ignored.

Offset: Offset = (subset * 4)

Output #: This value is for percent of PWM period that is ON. (Value is 0 (OFF) to 100 (ON)). If value is greater than 100, output is clipped to 100. If an output is not configured, the respective output field value shall be ignored.

Note: This message shall be returned from the specified power module to the Controller upon receipt of this message by the specified power module and when configured by the Echo Runtime byte of message 0x12. This acts as an “echo” confirmation of the data in the requested command.

Request for Information: Point to Point Message from CONTROLLER to Specified Power Module

BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE 4	BYTE 5	BYTE 6	BYTE 7
Command	Data Set	Unused	Unused	Unused			
0x7F	0x??	0xFF	0xFF	0xFF	0xFF	0xFF	0xF

Data Set: Determines which response the CONTROLLER wants.

0x00 = only status of output (0x90 message)

0x01 = current draw of outputs 0-3 (0x91 message)

0x02 = current draw of outputs 4-7 (0x92 message)

0x03 = all of the above (0x90, 0x91, 0x92 messages)

0x04 = Send Status of the outputs (0x93 message)

0x05 = Send Calibration Status (0x94 message)

If any other value is requested, a message does not report back, but the comm. fail timer is reset.

Output Diagnostic Data: Point to Point Message from Specified Power Module to CONTROLLER
This message is either an answer to request from CONTROLLER or sent on change

BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE 4	BYTE 5	BYTE 6	BYTE 7
Command	Unused	Outputs 0,1	Outputs 2,3	Outputs 4,5	Outputs 6,7	Unused	Unused
0x90	0xFF	0x??	0x??	0x??	0x??	0xFF	0xFF

Outputs #,#: Even output number is the MSN (Most Significant Nibble) and Odd number is LSN (Least Significant Nibble).

Value for each Nibble

- 0 = Okay
- 1 = Open (will only appear if diagnostic mode is enabled)
- 2 = Shorted Ground
- 3 = Shorted Battery
- 4 = Over Current Limit

Current Draw 1: Point to Point Message from Specified Power Module to CONTROLLER
This message is an answer to a request from CONTROLLER.

BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE 4	BYTE 5	BYTE 6	BYTE 7
Command	Unused	Output 0	Output 1	Output 2	Output 3	Unused	Unused
0x91	0xFF	0x??	0x??	0x??	0x??	0xFF	0xFF

Outputs #: The current draw of this output. (Value sent is * 100 MilliAmps)

Current Draw 2: Point to Point Message from Specified Power Module to CONTROLLER
This message is an answer to a request from CONTROLLER.

BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE 4	BYTE 5	BYTE 6	BYTE 7
Command	Unused	Outputs 4	Outputs 5	Outputs 6	Outputs 7	Unused	Unused
0x92	0xFF	0x??	0x??	0x??	0x??	0xFF	0xFF

Outputs #: The current draw of this output. (Value sent is * 100 MilliAmps)

Output Current Duty: Point to Point Message from Specified Power Module to CONTROLLER
This message is an answer to a request from CONTROLLER.

BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE 4	BYTE 5	BYTE 6	BYTE 7
Command	Subset	Not Used	Output 3 + Offset	Output 2 + Offset	Output 1 + Offset	Output 0 + Offset	Unused
0x93	0x??	0x00	0x??	0x??	0x??	0x??	0xFF

Subset: Offset = Subset * 4

0 = outputs 0-3

1 = outputs 4-7

Output #: This value is for percent of PWM period that is ON. (Value is **0** (OFF) to **100** (ON))

Output Configuration Message: Point to point message from CONTROLLER to Specified Power Module.
This message is not required for each Module

BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE 4	BYTE 5	BYTE 6	BYTE 7
Command	Diag Control	Unused	Unused	Unused	Unused	Unused	Unused
0x96	0x??	0xFF	0xFF	0xFF	0xFF	0xFF	0xFF

This message is used to turn off the diagnostic check circuit.

Diag Control:

The Diagnostic Circuit Control applies to all outputs. The circuit is either on for all outputs or off for all outputs

0 (or any other value) = Turn off the open load diagnostic check.

1 = Turn on the open load diagnostic check

Note: The module shall default to the check is off for all outputs.

Note: Configuration values shall be saved to non-volatile memory upon receipt of the save configuration message 0x13 from the controller. If 0x13 is not sent on that power-cycle, the configuration values shall revert back to the last saved configuration upon the next power cycle.

Note: This message shall be returned from the specified current control module to the controller upon receipt of this message and when configured by the Echo Configuration byte of message 0x12 by the specified power module. This acts as an “echo” confirmation of the proper configuration.

Temperature Request Message: Point to point message from CONTROLLER to Specified Power Module. This message is not required for each Module							
BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE 4	BYTE 5	BYTE 6	BYTE 7
Command	Byte 1	Byte 2	Unused	Unused	Unused	Unused	Unused
0x40	0x08	0x10	0xFF	0xFF	0xFF	0xFF	0xFF
Byte 0, Byte 1, and Byte 2 must match the above values for the power module to respond with the temperature.							
This message is used to poll the internal temperature read by the power module. Once the power module receives this message, it will respond with the Temperature Message.							

Temperature Message: Point to point message from Specified Power Module to CONTROLLER.							
BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE 4	BYTE 5	BYTE 6	BYTE 7
Command	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Temperature
0x90	0x01	0x02	0x03	0x04	0x05	0x06	0x??
This message is sent from power module in response to Temperature Request Message.							
Temperature: Temperature in degrees Celsius is sent in Byte 7. Decimal 40 is added to the value to incorporate negative values. Ex: Hex 0x0A = Decimal 10. Temperature = 10-40 = -30C.							

COM Fail Configuration Message: Point to point message from CONTROLLER to Specified Power Module.							
BYTE 0	BYTE 1	BYTE 2	BYTE 3	BYTE 4	BYTE 5	BYTE 6	BYTE 7
Command	Output CTRL	Unused	Unused	Unused	Unused	Unused	Unused
0x97	0x??	0xFF	0xFF	0xFF	0xFF	0xFF	0x0xFF
This message is sent from the controller to tell the power module to control outputs or not during communication loss.							
Output Control: Determines what outputs will do when we enter communication loss mode. 0x00 = Outputs will remain on when we lose communication. 0x01 = Outputs will cascade off (100ms between each output) when we lose communication.							