

	<a href="http://www.basler.com">www.basler.com</a> +1 618.654.2341 (USA) <a href="mailto:info@basler.com">info@basler.com</a>	Model	<b>BCM-2</b>
		Part Number	<b>Bridge Control Module</b>

## Introduction

The BCM-2 Bridge Control Module controls and monitors a single SCR controlled power bridge. It can be used with DECS-2100, ECS2100, or DECS-450 excitation systems. In a DECS-2100 or ECS2100 system, up to 16 power bridges with BCM-2s may be used in parallel to achieve the required current level and provide redundancy. In DECS-450 system, up to two power bridges may be operated in a redundant configuration.

Each BCM-2 generates the gating pulses for the six silicon-controlled rectifiers (SCRs) in a three-phase, full-wave, ac-to-dc power bridge. In a DECS-2100 system, SCR timing is determined by an ECM-2 (Excitation Control Module). In an ECS2100 system, SCR timing is determined by a Firing Control Interface Module (FCIM). In a DECS-450 system, timing is determined by the BCM-2.

The BCM-2 can be purchased with (9500500100) or without (9500500101) pulse transformers, depending on whether or not there are external transformers in the intended application.

Caution
<p>This product contains <i>nonvolatile memory</i> devices. Nonvolatile memory stores information (such as settings) to be preserved when the product is powered down. Established nonvolatile memory technologies have a physical limit on the number of times they can be erased and written. In this product, the limit is 100,000 erase/write cycles. During product application, consider communications, logic, and other factors that may cause frequent, repeated writes of settings or other information that the product retains. Frequent, repeated writes may reduce the product life and result in loss of information and/or product inoperability.</p>

## Specifications

### Power Supply Requirements

Voltage:	$\pm 24$ Vdc $\pm 10\%$
Current:	0.35 Adc nominal, 1.7 Adc maximum
Connectors:	+24V PS1, +24V PS2, -24V PS1, -24V PS2
Pin Assignments:	See Table 1.

**Table 1. Power Supply Pin Assignments**

	+24V			-24V	
	+	-	GND	+	-
<b>PS1</b>	22	21	20	26	25
<b>PS2</b>	19	18	17	24	23

### Analog Inputs

Inputs:	Six, programmable
Range:	10 Vac or $\pm 15$ Vdc

### Contact Inputs

Inputs:	Five, programmable, externally wetted
Nominal Sensing:	+24 Vdc or +125 Vdc/120 Vac (factory set, see <i>Digital Inputs</i> below for more information.)

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## Output Contacts

Outputs: Four, programmable, Form-C contacts

### AC Rating (resistive):

Carry: 7.0 Adc at 120 Vac  
Make and Break: 7.0 Adc at 120 Vac

### DC Rating (resistive):

Carry: 7.0 Adc at 24/125 Vdc  
Make and Break: 7.0 Adc at 24 Vdc  
0.7 Adc at 48 Vdc  
0.2 Adc at 125 Vdc

## Resistance Temperature Devices (RTD)

Type: 100  $\Omega$  platinum  
Monitoring Range: -15 to 235°C (5 to 455°F)  
Connectors: RTD1 – RTD7  
Pin Assignments: See Table 2.

**Table 2. RTD Pin Assignments**

RTD	1	2	3	4	5	6	7
+	39	42	45	48	51	54	57
-	40	43	46	49	52	55	58
Shield	41	44	47	50	53	56	59

## Communication Interface

### USB Port

Type: USB 2.0, Type-B  
Data Transfer Speed: 12 Mbps (full speed)

### Ethernet Port

Type: RJ-45, eight-pin, 10/100/1000 BASE-TX

## Bridge Communication

Type: Fiber optic link  
Connectors  
Single-Channel: F1, F2  
Dual-Channel: F1-F4  
Triple-Channel: F1-F6

## CE and UKCA Compliance

This product has been evaluated and complies with the relevant essential requirements set forth by the EU legislation and UK Parliament as part of a system, not as a standalone device.

### EC Directives:

- Low Voltage Directive (LVD) 2014/35/EU
- Electromagnetic Compatibility (EMC) 2014/30/EU
- Hazardous Substances (RoHS2) 2011/65/EU

### Harmonized Standards used for Evaluation

- IEC 62103:2003
- EN 62477-1:2012
- EN 61000-6-2:2005
- EN 61000-6-4:2007; with AMD 1:2011
- EN 50581:2012, Ed 12

## FCC Requirements

This product complies with FCC 47 CFR Part 15.

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## China RoHS

The following table serves as the declaration of hazardous substances for China in accordance with PRC standard SJ/T 11364-2014. The EFUP (Environment Friendly Use Period) for this product is 40 years.

PRODUCT: BCM-2										
零件名称 Part Name	有害物质 Hazardous Substances									
	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr <sup>6+</sup> )	多溴联苯 Polybrominated Biphenyls (PBB)	多溴二苯醚 Polybrominated Diphenyl Ethers (PBDE)	邻苯二甲 酸二丁酯 Dibutyl Phthalate (DBP)	邻苯二甲 酸丁苄酯 Benzyl butyl phthalate (BBP)	邻苯二甲 酸二酯 Bis(2- ethylhexyl) phthalate (BEHP)	邻苯二甲 酸二异丁 酯 Diisobutyl phthalate (DIBP)
金属零件 Metal parts	O	O	O	O	O	O	O	O	O	O
聚合物 Polymers	O	O	O	O	O	O	O	O	O	O
电子产品 Electronics	X	O	O	O	O	O	O	O	O	O
电缆和互连配 件 Cables & interconnect accessories	X	O	O	O	O	O	O	O	O	O
绝缘材料 Insulation material	O	O	O	O	O	O	O	O	O	O

本表格依据 SJ/T11364 的规定编制。

O: 表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。

X: 表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。

This form was prepared according to the provisions of standard SJ/T11364.

O: Indicates that the hazardous substance content in all homogenous materials of this part is below the limit specified in standard GB/T 26252.

X: Indicates that the hazardous substance content in at least one of the homogenous materials of this part exceeds the limit specified in standard GB/T 26572.

## Environment

### Temperature

Operating: -40 to 60°C (-40 to 140°F)

Storage: -40 to 65°C (-40 to 149°F)

Ingress Protection Class: IP20

Humidity: 0 to 95%, non-condensing

### Physical

Weight: 4.5 lb (2.04 kg)

Size (W x H x D): 14.10 x 7.76 x 2.75 inches (358.1 x 197.1 x 69.85 mm)

## Installation

The BCM-2 is typically preinstalled in the excitation control system. If replacement is necessary, save the configuration with BESTCOMS™ Pro software and then de-energize the system. Carefully label and document each of the connections to the BCM-2 in order to properly reconnect the new module. Prior to installation, configure digital input switches IN1-IN5 for the proper interrogation voltage, the bridge number, and the SCR Rating Selection Jumpers. Reinstall all connectors and energize. Once the BCM-2 has been powered up, load the appropriate configuration file for the system.

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**Table 3. BCM-2 Connector and Indicator Descriptions**

Locator	Description																																																																																					
A	Digital input connectors In1 through In5 accommodate 24 Vdc, 125 Vdc, or 120 Vac.																																																																																					
B	Auxiliary 10 Vac / ±15 Vdc analog input connectors Ch1 through Ch6.																																																																																					
C	Form-C relay output contact connectors Out1 through Out4 accommodate 125 Vdc/120 Vac, maximum.																																																																																					
D	RJ-45 Ethernet communication port.																																																																																					
E	Redundant power supply input connectors +24 V PS1, +24 V PS2, –24 PS1, and –24 PS2.																																																																																					
F	USB, Type-B communication port.																																																																																					
G	SCR gate pulse output connectors. G = Gate, K = Cathode.																																																																																					
H	Conduction Monitor, Diagnostic, Programmable, Contact Input, and Relay Output LED indicators. See <i>LED Indicators</i> for more information.																																																																																					
I	Fiber optic communication connectors. F1 and F2 connect to the main channel ECM-2 or FCIM. F3 and F4 connect to the redundant channel ECM-2 or FCIM. F5 and F6 connect to the third channel ECM-2 or FCIM. F7, F8, F9, and F10 connect to the system IT modules (if equipped).																																																																																					
J	Conduction monitor input connectors CM1, CM2, and CM3.																																																																																					
K	<p>Bridge Number selection switches.</p> <table border="1"> <thead> <tr> <th>Bridge Address</th> <th>Switch 1</th> <th>Switch 2</th> <th>Switch 4</th> <th>Switch 8</th> </tr> </thead> <tbody> <tr><td>0</td><td>Up</td><td>Up</td><td>Up</td><td>Up</td></tr> <tr><td>1</td><td>Down</td><td>Up</td><td>Up</td><td>Up</td></tr> <tr><td>2</td><td>Up</td><td>Down</td><td>Up</td><td>Up</td></tr> <tr><td>3</td><td>Down</td><td>Down</td><td>Up</td><td>Up</td></tr> <tr><td>4</td><td>Up</td><td>Up</td><td>Down</td><td>Up</td></tr> <tr><td>5</td><td>Down</td><td>Up</td><td>Down</td><td>Up</td></tr> <tr><td>6</td><td>Up</td><td>Down</td><td>Down</td><td>Up</td></tr> <tr><td>7</td><td>Down</td><td>Down</td><td>Down</td><td>Up</td></tr> <tr><td>8</td><td>Up</td><td>Up</td><td>Up</td><td>Down</td></tr> <tr><td>9</td><td>Down</td><td>Up</td><td>Up</td><td>Down</td></tr> <tr><td>10</td><td>Up</td><td>Down</td><td>Up</td><td>Down</td></tr> <tr><td>11</td><td>Down</td><td>Down</td><td>Up</td><td>Down</td></tr> <tr><td>12</td><td>Up</td><td>Up</td><td>Down</td><td>Down</td></tr> <tr><td>13</td><td>Down</td><td>Up</td><td>Down</td><td>Down</td></tr> <tr><td>14</td><td>Up</td><td>Down</td><td>Down</td><td>Down</td></tr> <tr><td>15</td><td>Down</td><td>Down</td><td>Down</td><td>Down</td></tr> </tbody> </table>	Bridge Address	Switch 1	Switch 2	Switch 4	Switch 8	0	Up	Up	Up	Up	1	Down	Up	Up	Up	2	Up	Down	Up	Up	3	Down	Down	Up	Up	4	Up	Up	Down	Up	5	Down	Up	Down	Up	6	Up	Down	Down	Up	7	Down	Down	Down	Up	8	Up	Up	Up	Down	9	Down	Up	Up	Down	10	Up	Down	Up	Down	11	Down	Down	Up	Down	12	Up	Up	Down	Down	13	Down	Up	Down	Down	14	Up	Down	Down	Down	15	Down	Down	Down	Down
Bridge Address	Switch 1	Switch 2	Switch 4	Switch 8																																																																																		
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L	Bridge heat sink temperature input connectors RTD1 through RTD7. See <i>Specifications</i> for pin assignments. The BCM-2 accepts inputs only from platinum, 100 Ω RTDs.																																																																																					
M	Channel selection input connectors Main/Red and Channel 3.																																																																																					

## BCM-2 Connections

BCM-2 connections consist of screw terminal connectors, fiber optic connectors, conduction monitor connectors, and USB and Ethernet ports for PC connection. Figure 1 illustrates the locations of all BCM-2 connectors. Locator letters in Figure 1 correspond to the lettered descriptions in Table 3.

### Screw Terminal Connectors

Connectors with screw-down compression terminals are used for the analog inputs, digital inputs and outputs, operating power inputs, SCR gate firing outputs, RTD inputs, and channel selection inputs. The connectors, and the headers that they plug into, have a dovetailed edge that ensures proper connector orientation. Similar-sized connectors and headers are uniquely keyed to ensure that a connector mates only with the correct header to prevent damage to the BCM-2. However, care must still be taken to ensure that the proper connector is inserted into the appropriate header. Connector screw terminals accept a maximum wire size of 12 AWG. The maximum screw torque is 5.3 in-lb or 0.6 N•m.

### Fiber Optic Connectors

Fiber optic connectors are used for communication with the ECM-2 or FCIM and isolation transducers (if equipped). Depending on the specific design, dual fiber optic cable assemblies are provided for these connections in various lengths.

### Conduction Monitor Connectors

Ten-pin ribbon cable connectors (supplied) are used for communication with the conduction monitor.

### PC Connection for BESTCOMS™Pro

A PC running BESTCOMSPro may be connected directly to the BCM-2 through its USB or Ethernet port as described below.

#### Ethernet Connection

1. Connect a PC to the BCM-2 with a standard Ethernet cable.
2. Click *Connect* under the *File* menu. The *Connect* dialog box appears as shown in Figure 2.
3. Select the Ethernet tab.
4. Click the down arrow to the right of the Host Name drop down list, a list of options appears.

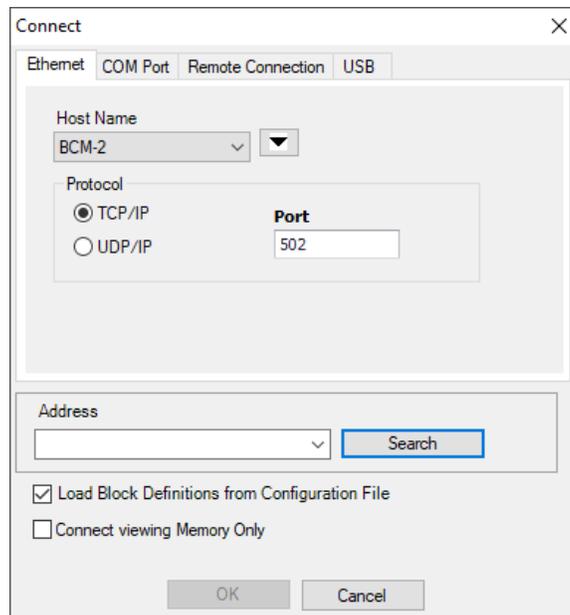
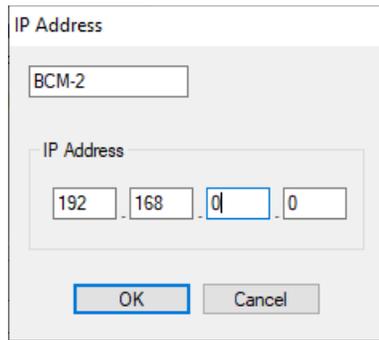


Figure 2. Connection Window, Ethernet Tab

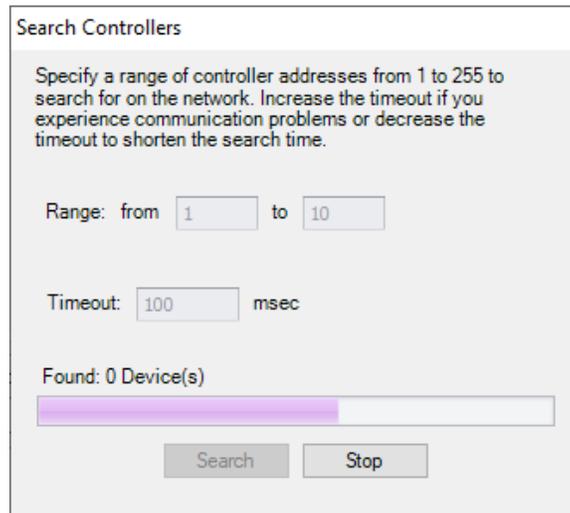
5. Click Add IP address. The IP Address dialog appears as shown in Figure 3.

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**Figure 3. Adding an IP Address**

6. Enter the desired name of the new connection in the top field.
7. Enter the IP address in the bottom four fields and click *OK*.
8. Click *Search*. The Search Controllers dialog box appears as shown in Figure 4.



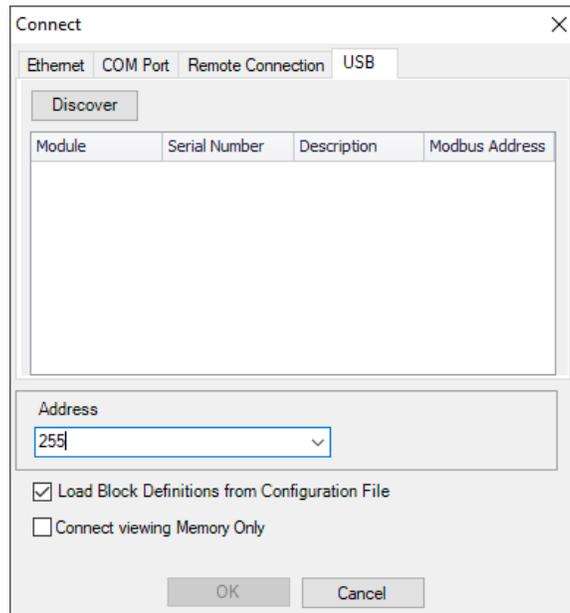
**Figure 4. Searching for Controllers**

9. BESTCOMSP $ro$  searches for connected devices. The search process can be shortened by decreasing the range and timeout duration.
10. Click *Close* after the search is complete.
11. Select the BCM-2 from the Address Drop down List and Click *OK*.
12. Wait for the connection process to complete.

### USB Connection

1. Connect a PC to the BCM-2 with a Type-B USB cable.
2. The *Found New Hardware Wizard* appears after powering on the BCM-2 and connecting the USB cable.
3. Select, “No, not this time.” and click *Next*.
4. Select, “Install the software automatically (Recommended)”, and click *Next*.
5. Wait for the installation to complete. Click *Finish*.
6. Click *Connect* under the *File* menu.
7. The *Connect* dialog box appears as shown in Figure 5.
8. Select the USB Tab.
9. Input “255” into the Address field.
10. Click *OK* and wait for the connection process to complete.

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**Figure 5. Connection Window, USB Tab**

### Manual USB Driver Installation

If USB port communication is not established automatically by Windows®, a Driver Software Installation error message will be displayed. In this case, the BCM-2 USB driver can be installed manually by performing the following steps.

1. Open the Windows Device Manager. Under Other Devices, right-click on BCM-2 (or Unknown Device) and select Properties.
2. In the Properties window, select the Driver tab and click the Update Driver button.
3. Select “Browse my computer for driver software” and then navigate to:

C:\Program Files\Basler Electric\USB Device Drivers\USBIO

4. Install the USB driver software. Successful installation will be indicated by a confirmation message.

### Indirect Connection for DECS-2100 Systems

An indirect connection to the BCM-2 may be established through an ECM-2 or FCIM connected to the BCM-2 through fiber optic link. After assuring the BCM-2 is energized, run BESTCOMSPro by following the instructions in the Instruction Manual for Excitation Control Module ECM-2, Basler Publication 9411300990.

### Modbus Address

A Modbus address may be assigned to a BCM-2, although it is not required.

### BCM-2 Setup

BCM-2 setup consists of bridge address selection and BESTCOMSPro software connection (above).

#### Bridge Address Switch

The BCM-2’s four-position DIP switch, labeled Bridge Number, configures the BCM-2 address with a value ranging from 0 to 15. See Figure 1 for the location of the switch. Table 3 shows the switch settings for the range of addresses. The Bridge Address Switch is not used with a DECS-450 system.

### Operation

The output of a power bridge is connected to the field winding of a generator or an interposing exciter. A full-wave bridge configuration permits both positive and negative forcing voltage to be applied to the field winding. Negative output voltage occurs only transiently as the bridge removes stored energy in the field winding. The field current, however, cannot be reversed.

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### SCR Gate Firing Output

The BCM-2 provides gate signals to the six power bridge SCRs. It also receives and interprets the inputs from interface devices, conduction monitors, dc current shunts, and RTD temperature sensors. The BCM-2 monitors and controls the starting and stopping of the bridge through activation and deactivation of local breakers or contactors.

### Control Communication

In a DECS-2100 application, the ECM-2 or FCIM performs the necessary ac power line synchronizing using a software-calculated phase-locked loop (PLL) based on isolated three-phase voltage signals from an isolation transducer (IT-2) module. Firing signals integrated with data signals are transmitted to as many as 16 paralleled BCM-2s over fiber optic cables. These signals are sent using a custom communication protocol, implemented by a field programmable gate array (FPGA). Data communication is bidirectional between the BCM-2 and the ECM-2 or FCIM. All significant alarm and operating data from the BCM-2 is passed to the ECM-2 or FCIM. The software-based control configuration is programmable and viewable in table or block diagram form, using BESTCOMSPro.

In a DECS-450 application, the BCM-2 performs the necessary ac power line synchronizing using a software-calculated phase-locked loop (PLL) based on isolated three-phase voltage signals from an isolation transducer (IT-2) module. It uses this synchronizing information along with a  $\pm 10$  V control signal (Channel 5) from the DECS-450 on an analog input to determine SCR gate timing.

### Operating Power

BCM-2 operating power is provided through the redundant +24 Vdc PS1 and PS2 connectors and -24 Vdc PS1 and PS2 connectors.

### Isolation Transducer Modules (If Equipped)

Four fiber optic receivers, F7 through F10, use single fiber optic cable assemblies to receive signals from two isolation transducer modules, with one positive and one negative channel per module.

The IT-2 inputs are the primary interface for bridge input voltage sensing to the BCM-2. The IT-2 monitors bridge input voltages  $V_{a-b}$  and  $V_{b-c}$ , and converts them to signals used by the BCM-2 for gate pulse synchronization.

When used with the DECS-450, the F7 and F8 fiber inputs are used with the IT-2 for the synchronization input.

Refer to Figure 1 and the job-specific schematics for connection locations.

### Digital Inputs

Five sets of terminals accept wetted contact inputs from external switches or other system devices. Contact inputs can be individually configured within BESTCOMSPro to trigger BCM-2 responses to the inputs. Contact inputs are designated In1, In2, In3, In4, and In5. In1 terminal assignments are 4 (+) and 3 (-), In2 terminal assignments are 2 (+) and 1 (-), In3 terminal assignments are 66 (+) and 67 (-), In4 terminal assignments are 68 (+) and 69 (-), and In5 terminal assignments are 70 (+) and 71 (-).

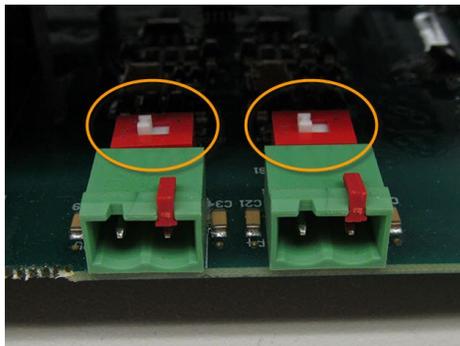


Figure 6. In1 and In2 Switch Locations

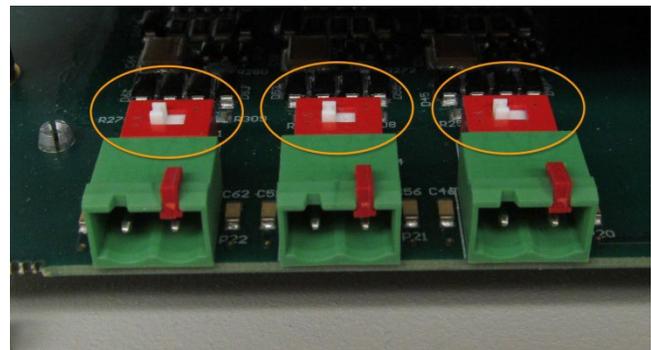


Figure 7. In3, In4, and In5 Switch Locations

The interrogation voltage for each contact input is switch-selectable and set at the factory for 24 Vdc or 125 Vdc/120 Vac depending on the DECS-2100 or DECS-450 system configuration. If the BCM-2 is supplied as a stand-alone or replacement unit, the switches should be set according to your system. The switches are accessed just behind the In1 and In2 connectors on the top of the unit (Figure 6) and just behind the In3, In4, and In5 connectors on the bottom of the unit (Figure 7).

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## Caution

Ensure that the unit is de-energized before setting the contact input switches. A thin, nonconductive rod should be used to set the switches.

To configure a contact input for 125 Vdc/120 Vac, set the switch to the left position (toward the positive terminal of the input). To configure a contact input for 24 Vdc, set the switch to the right position (toward the negative terminal of the input).

### Digital Outputs

Four pairs of form-C output contacts are provided. Their functions are programmable in BESTCOMSPro.

### Analog Inputs

The BCM-2 provides six analog inputs that are programmable in BESTCOMSPro. These inputs accept 10 Vac or  $\pm 15$  Vdc.

### Channel Selection Inputs

These inputs configure the BCM-2 to communicate with the main, redundant, or third channel controllers depending on the voltage applied. Application of 0 Vdc for single-channel systems or +24 Vdc for multi-channel systems at Main/Red (pin 60 (+), pin 61 (-)) configures the BCM-2 to communicate with the main-channel ECM-2 or FCIM through connectors F1 and F2. Application of -24 Vdc at Main/Red (pin 60 (-), pin 61 (+)) configures the BCM-2 to communicate with the redundant-channel ECM-2 or FCIM through connectors F3 and F4. Application of +24 Vdc at Channel 3 (pin 63 (+), pin 64 (-)) configures the BCM-2 to communicate with the third-channel ECM-2 or FCIM through connectors F5 and F6. This overrides Main/Red channel selection.

### RTD Inputs

The temperature of each power bridge SCR, as well as the ambient temperature, is measured using RTDs. No calibration is required. The device cables plug into RTD1 through RTD7.

### Conduction Monitor

The BCM-2 implements conductivity sensing for the six SCRs on each power bridge. The conduction monitor sensors continuously sample the level of current on each SCR. By selecting samples of current at particular times within the conduction intervals of each SCR, the accuracy of current estimations are improved by avoiding commutation overlap intervals. The conduction monitor inputs are CM1 through CM3.

## Programming

The BCM-2 follows a set of preprogrammed instructions, referred to as code, to perform a variety of functions. Using BESTCOMSPro, code can be modified. This capability permits the firmware, startup, running, and shutdown sequence logic to be changed on-site. This function is useful during initial startup, fine-tuning procedures and system maintenance. The three specific classes of code that can be changed are boot firmware, code firmware, and logic configuration.

### **Boot Firmware**

Boot firmware is code that controls the BCM-2 power-up, communications, and the upload/download process. The boot bank of flash RAM controls the firmware download process. When downloading new boot firmware, the existing firmware is used. Then, the new firmware must be moved to the memory location that is executed at power-up. Since boot code is relatively simple and not likely to change, this is an infrequent event.

### **Code Firmware**

BCM-2 features and functions are stored in code firmware. Code firmware can be uploaded or down-loaded with BESTCOMSPro.

### **Logic Configuration**

The logic configuration consists of interconnected logic blocks which interact with control inputs and hardware outputs. Each system initially uses a standardized and pretested logic configuration. Adjustments are made to satisfy individual site-specific application requirements. The logic configuration is installed in the BCM-2 during

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production assembly and testing. This custom configuration is also supplied with the other digital documentation for the system.

BESTCOMS*Pro* allows copying and modification of the provided configuration stored within the flash RAM of the BCM-2. Modification of the original configuration may be as simple as gain adjustments or as complex as changes to the block structure. The functions of many of the logic blocks within the configuration are governed by constant inputs. The constants may be modified dynamically during operation. Gains, scale factors, and time constants can be adjusted to improve operation. Values or states may be forced within the logic configuration. This is generally done for the sake of debugging or to temporarily compensate for operational problems.

## Monitoring

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The BCM-2 operates independently of any user intervention. However, aspects of operation may be monitored or controlled through BESTCOMS*Pro* or the BCM-2 LED indicators.

### Alarms

Using BESTCOMS*Pro*, the user may monitor and respond to alarms, trips, and other system exceptions.

### Event Recorder

Four configurable event recorder blocks are capable of capturing up to eight input event records per recorder block. There are 100,000 points of data dedicated to each recorder block. Data point collection intervals can be as short as one millisecond. BCM-2 event recorder functions are configured in BESTCOMS*Pro*. For more information, refer to the Instruction Manual for Excitation Control Module ECM-2, Basler Publication 9411300990.

### Exciter Diode Monitor

The exciter diode monitor (EDM) monitors exciter field current, through a programmable BCM-2 analog input (Ch4, Ch5, or Ch6), to detect open or shorted rotating diodes in the exciter bridge. Upon detection of an open or shorted diode, an alarm is annunciated. The EDM alarm is programmable in BESTCOMS*Pro* and can be configured to energize a BCM-2 output contact.

### Fan Control

The primary and backup bridge cooling fans may be configured using BESTCOMS*Pro* for main/backup operation or simultaneous operation. A fan test sequence can also be executed to verify proper operation.

### LED Indicators

All LEDs are located on the BCM-2 near the fiber optic connectors. See Figure 1.

#### Conduction Monitor LEDs

Six conduction monitor LEDs are provided. When a conduction monitor senses conduction in an SCR, the corresponding LED lights. If a conduction monitor senses no conduction in its SCR, the corresponding LED is off.

#### Diagnostic LEDs

Four diagnostic LEDs are provided: +24V Power, Operating State, Bridge Alarm, and Link Alarm.

#### +24V Power

This green LED lights to indicate the presence of BCM-2 operating power at either of the power supply inputs (PS1 or PS2).

#### Operating State

This green LED annunciates three operating states of BCM-2 code. When the function block logic within the user's application program is not being executed by the BCM-2 firmware, this indicator is not lit. A flashing indicator annunciates that execution of the logic within the user's application program is occurring but the DECS-2100, ECS2100, or DECS-450 system is offline (41A breaker open). Execution of application logic in an online (41A breaker closed) DECS-2100, ECS2100, or DECS-450 system is annunciates by a steadily-lit indicator.

#### Bridge Alarm

This red LED lights when a power bridge problem or failure is detected by the BCM-2. It is also communicated to the ECM-2 in DECS-2100 systems or FCIM in ECS2100 systems.

#### Link Alarm

This red LED lights to indicate a loss of fiber optic signals between the BCM-2 and ECM-2 in DECS-2100 systems or BCM-2 and FCIM in ECS2100 systems.

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### Programmable LEDs

Four programmable LEDs are provided. The signals that trigger an LED to illuminate are customizable and controlled by the DIG\_OUT logic block. Use BESTCOMSPro to view the block diagram representation of the DIG\_OUT block within the BCM-2 configuration. This displays the input signals that currently trigger the LEDs and allows customization of those input signals.

### Contact Inputs

When a contact is sensed at one of the inputs, the corresponding LED lights.

### Relay Outputs

When one of the output relays energizes, the corresponding LED lights.

## Logic Blocks

All of the logical states, input/output values, and memory contents used and generated by the logic configuration are viewable using BESTCOMSPro.

## Real-Time Monitoring

BESTCOMSPro Real-Time Monitoring (RTM) Analysis can be used to perform and monitor on-line AVR and PSS testing. Up to six plots of user-selected data can be generated and the logged data can be stored in a file for later examination. For more information, refer to the ECM-2 Excitation Control Module instruction manual, Basler publication 9411300990.

## SCR Temperature Monitor

This function monitors the temperatures of the six power bridge SCRs and the ambient temperature using the seven BCM-2 RTD connections. In BESTCOMSPro, the bridge cooling fans may be programmed to turn on when temperatures exceed predefined thresholds and turned off when the temperatures are below predefined thresholds.

## Sequence of Events Logging

A time- and date-stamped list of up to 16,000 internal and user-defined variables are logged. User-defined variables are selected in BESTCOMSPro. For more information, refer to the ECM-2 Excitation Control Module instruction manual, Basler publication 9411300990.

## Diagnostics

Diagnostic functions within the BCM-2 and BESTCOMSPro can help localize the source of problems. These diagnostic functions include checksums, a watchdog timer, and tests performed by BESTCOMSPro. For module replacement, refer to the *Installation* section, above.

Potential maintenance procedures include monitoring LED indicators, monitoring logic block operation within BESTCOMSPro, adjusting logic block parameters, uploading or downloading boot code and configuration firmware, and running the BESTCOMSPro communication test.

## Checksum

A checksum of the operating firmware is calculated when the BCM-2 is powered on. If the checksum is incorrect, the application firmware is not executed, the BCM-2 remains within boot mode, and the separate boot code in the boot flash memory is executed instead.

## Watchdog Timer

The watchdog timer is a hardware function within the BCM-2 microprocessor which resets the system if the software does not periodically send a signal into the timer. If the watchdog timer resets the system, an alarm is tripped.

## Communication Tests

BESTCOMSPro provides communication test functions. Write and read actions are carried out either directly to a BCM-2 or through the ECM-2 or FCIM to multiple BCM-2s. By running the communication tests, the operational status of multiple subsystems, including processors and fiber optic channels, can be verified.

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## Bridge Control Module (BCM) Retrofit

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The BCM-2 is a direct replacement for the BCM. A BCM-2 can be installed in place of a BCM using the same mounting holes and hardware. All BCM-2 connectors are near the same location as BCM connectors for easy reconnection.

Contact Basler Electric to order a BCM-2 Retrofit Kit (Basler P/N 9500505100).

## Maintenance

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This equipment contains solid-state components and requires no preventive maintenance.

## Storage

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This device contains long-life aluminum electrolytic capacitors. For devices that are not in service (spares in storage), the life of these capacitors can be maximized by energizing the device for 30 minutes once per year.

## Spare Parts

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A reasonable stock of spare parts minimizes downtime in the event of malfunction. When ordering spare parts, care should be taken to specify the style numbers (or other identification) which are printed on the nameplate. Careful documentation of the original connections is essential any time the BCM-2 is removed.

It is recommended that at least one BCM-2 and several 0.1 inch (2.54 mm) plastic-housed jumpers are stocked.

## SCR Current Rating Jumper Settings

When replacing a BCM-2, the SCR rating jumpers must be properly configured on the replacement BCM 2. For more information, see *SCR Rating Selection Jumpers*, below.

## Safety

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As with all electrical equipment, appropriate safety measures must be taken when dealing with excitation equipment. High voltage is present within the excitation cubicles; their magnitudes depend upon the particular system. Opening the sources (e.g., disconnecting device 41) does not completely disconnect the high voltages. As long as the machine is still physically connected to the system, there is a possibility that a safety hazard exists.

### Warning!

Bodily injury could result if contact is made with components in this apparatus which carry either line voltage or are subject to abnormally high voltages. References to the circuit diagrams, notably within other documentation, disclose hazardous areas.

Every precaution must be taken when working at the excitation control switchgear to ensure that all high voltages are isolated and avoided by test personnel. In addition to the machine terminal voltage (460 Vac or greater) at the excitation transformer, there may be other sources of power entering the cubicles, such as 125/250 Vdc and/or 120/240 Vac used to feed certain devices. A good rule to follow is to assume that all connections are live and dangerous until proven otherwise and to avoid all body contact with any of these voltages.

## SCR Rating Selection Jumpers

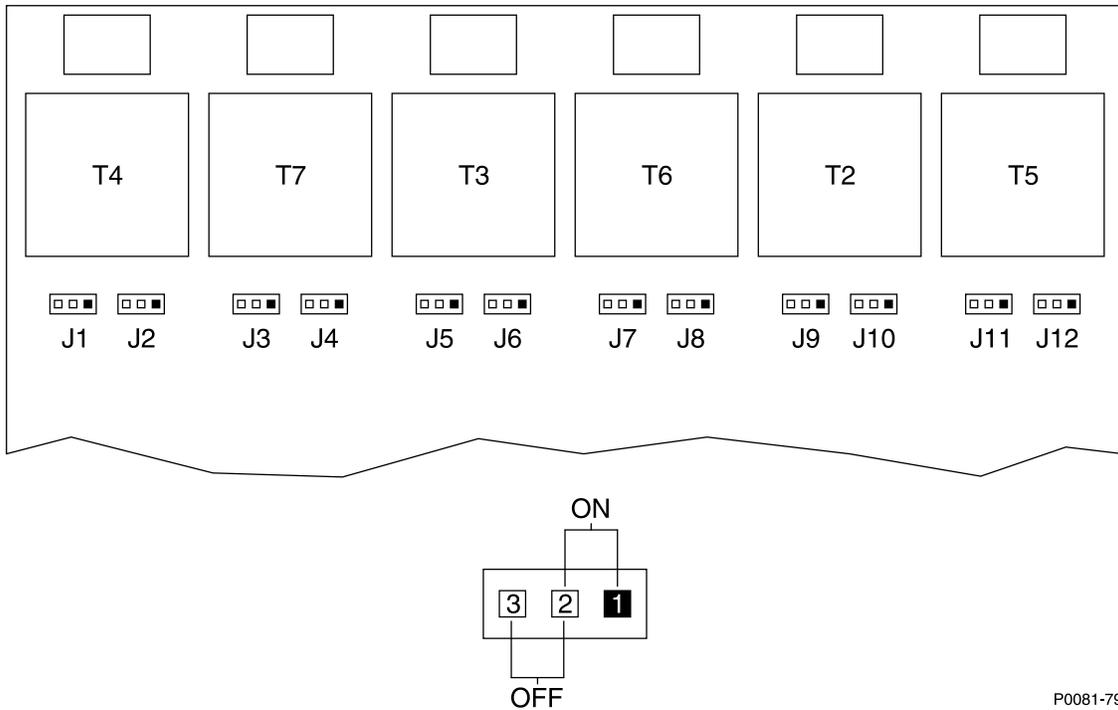
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SCR rating selection jumpers are configured at the factory according to the type/rating of the power bridge used in the system. When replacing a BCM-2, the configuration of these jumpers on the replacement BCM-2 must be adjusted to match the jumper configuration on the BCM-2 module being replaced. Removal of the BCM-2 cover is required to adjust these jumpers. For reference only, Table 4 provides the jumper positions for each power bridge type. The jumpers are located near T2 through T7 on the lower BCM-2 board, see Figure 8.

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**Table 4. SCR Rating Selection Jumpers**

Jumper	Power Bridge Type					
	20-600 A Fixed	1,100 A Draw-Out Low Voltage	1,100 A Draw-Out Medium and High Voltage	2,000 A Fixed	DECS-450 SSE-N Bridge	Default Spare Configuration
J1	OFF	OFF	ON	ON	OFF	OFF
J2	ON	ON	ON	ON	ON	ON
J3	OFF	OFF	ON	ON	OFF	OFF
J4	ON	ON	ON	ON	ON	ON
J5	OFF	OFF	ON	ON	OFF	OFF
J6	ON	ON	ON	ON	ON	ON
J7	OFF	OFF	ON	ON	OFF	OFF
J8	ON	ON	ON	ON	ON	ON
J9	OFF	OFF	ON	ON	OFF	OFF
J10	ON	ON	ON	ON	ON	ON
J11	OFF	OFF	ON	ON	OFF	OFF
J12	ON	ON	ON	ON	ON	ON



**Figure 8. SCR Rating Selection Jumper Locations**

P0081-79

## Modbus® Mapping

Modbus input signal mapping, output signal mapping, and fixed mapping are described in the following paragraphs.

### Modbus Input Signal Mapping (MBIN)

This block is used to support Modbus communication with both local and remote devices. The block provides input processing for both floating point (holding registers) and logical (coil) type input signals.

#### Block Inputs

The MBIN\_CONFIG constant input parameter is used to define the high-order and low-order byte sequence of register pairs representing 32-bit floating point values.

Constant Input Parameter values are listed in Table 5.

**Table 5. MBIN\_CONFIG**

Constant Input Parameter	Scale	Lower Value	Upper Value	Typical Value
MBIN_CONFIG	T/F	F	T	T

#### Block Outputs

Feedback Control Outputs are listed in Table 6

**Table 6. Feedback Control Outputs**

Output Variable	Type	Scale	Definition / Signal
MBIN_1001	Floating Point	PU	Value written to Modbus holding registers 41001 and 41002
MBIN_1002	Floating Point	PU	Value written to Modbus holding registers 41003 and 41004
MBIN_1003	Floating Point	PU	Value written to Modbus holding registers 41005 and 41006
MBIN_1004	Floating Point	PU	Value written to Modbus holding registers 41007 and 41008
MBIN_1005	Floating Point	PU	Value written to Modbus holding registers 41009 and 41010
MBIN_1006	Floating Point	PU	Value written to Modbus holding registers 41011 and 41012
MBIN_1007	Floating Point	PU	Value written to Modbus holding registers 41013 and 41014
MBIN_1008	Floating Point	PU	Value written to Modbus holding registers 41015 and 41016
MBIN_1009	Floating Point	PU	Value written to Modbus holding registers 41017 and 41018
MBIN_1010	Floating Point	PU	Value written to Modbus holding registers 41019 and 41020
MBIN_1011	Floating Point	PU	Value written to Modbus holding registers 41021 and 41022
MBIN_1012	Floating Point	PU	Value written to Modbus holding registers 41023 and 41024
MBIN_1013	Floating Point	PU	Value written to Modbus holding registers 41025 and 41026
MBIN_1014	Floating Point	PU	Value written to Modbus holding registers 41027 and 41028
MBIN_1015	Floating Point	PU	Value written to Modbus holding registers 41029 and 41030
MBIN_1016	Floating Point	PU	Value written to Modbus holding registers 41031 and 41032
MBIN_COIL2001	Logic	T/F	State written to Modbus coil address 2001
MBIN_COIL2002	Logic	T/F	State written to Modbus coil address 2002
MBIN_COIL2003	Logic	T/F	State written to Modbus coil address 2003
MBIN_COIL2004	Logic	T/F	State written to Modbus coil address 2004
MBIN_COIL2005	Logic	T/F	State written to Modbus coil address 2005
MBIN_COIL2006	Logic	T/F	State written to Modbus coil address 2006
MBIN_COIL2007	Logic	T/F	State written to Modbus coil address 2007
MBIN_COIL2008	Logic	T/F	State written to Modbus coil address 2008
MBIN_COIL2009	Logic	T/F	State written to Modbus coil address 2009
MBIN_COIL2010	Logic	T/F	State written to Modbus coil address 2010
MBIN_COIL2011	Logic	T/F	State written to Modbus coil address 2011
MBIN_COIL2012	Logic	T/F	State written to Modbus coil address 2012

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Output Variable	Type	Scale	Definition / Signal
MBIN_COIL2013	Logic	T/F	State written to Modbus coil address 2013
MBIN_COIL2014	Logic	T/F	State written to Modbus coil address 2014
MBIN_COIL2015	Logic	T/F	State written to Modbus coil address 2015
MBIN_COIL2016	Logic	T/F	State written to Modbus coil address 2016
MBIN_COIL2017	Logic	T/F	State written to Modbus coil address 2017
MBIN_COIL2018	Logic	T/F	State written to Modbus coil address 2018
MBIN_COIL2019	Logic	T/F	State written to Modbus coil address 2019
MBIN_COIL2020	Logic	T/F	State written to Modbus coil address 2020
MBIN_COIL2021	Logic	T/F	State written to Modbus coil address 2021
MBIN_COIL2022	Logic	T/F	State written to Modbus coil address 2022
MBIN_COIL2023	Logic	T/F	State written to Modbus coil address 2023
MBIN_COIL2024	Logic	T/F	State written to Modbus coil address 2024
MBIN_COIL2025	Logic	T/F	State written to Modbus coil address 2025
MBIN_COIL2026	Logic	T/F	State written to Modbus coil address 2026
MBIN_COIL2027	Logic	T/F	State written to Modbus coil address 2027
MBIN_COIL2028	Logic	T/F	State written to Modbus coil address 2028
MBIN_COIL2029	Logic	T/F	State written to Modbus coil address 2029
MBIN_COIL2030	Logic	T/F	State written to Modbus coil address 2030
MBIN_COIL2031	Logic	T/F	State written to Modbus coil address 2031
MBIN_COIL2032	Logic	T/F	State written to Modbus coil address 2032

### Modbus Output Signal Mapping (MBOU)

This block is used to support Modbus communication with both local and remote devices. The block provides output processing for both floating point (holding registers) and logical (coil) type input signals.

#### Block Inputs

Block inputs are listed in Table 7.

**Table 7. Block Inputs**

Input Variable	Type	Scale	Definition / Notes / Typical Usage
MBOU_33	Floating Point	PU	Value available at Modbus holding registers 41065 and 41066
MBOU_34	Floating Point	PU	Value available at Modbus holding registers 41067 and 41068
MBOU_35	Floating Point	PU	Value available at Modbus holding registers 41069 and 41070
MBOU_36	Floating Point	PU	Value available at Modbus holding registers 41071 and 41072
MBOU_37	Floating Point	PU	Value available at Modbus holding registers 41073 and 41074
MBOU_38	Floating Point	PU	Value available at Modbus holding registers 41075 and 41076
MBOU_39	Floating Point	PU	Value available at Modbus holding registers 41077 and 41078
MBOU_40	Floating Point	PU	Value available at Modbus holding registers 41079 and 41080
MBOU_41	Floating Point	PU	Value available at Modbus holding registers 41081 and 41082
MBOU_42	Floating Point	PU	Value available at Modbus holding registers 41083 and 41084
MBOU_43	Floating Point	PU	Value available at Modbus holding registers 41085 and 41086

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Input Variable	Type	Scale	Definition / Notes / Typical Usage
MBOUT_44	Floating Point	PU	Value available at Modbus holding registers 41087 and 41088
MBOUT_45	Floating Point	PU	Value available at Modbus holding registers 41089 and 41090
MBOUT_46	Floating Point	PU	Value available at Modbus holding registers 41091 and 41092
MBOUT_47	Floating Point	PU	Value available at Modbus holding registers 41093 and 41094
MBOUT_48	Floating Point	PU	Value available at Modbus holding registers 41095 and 41096
MBOUT_COIL2065	Logic	T/F	State available to Modbus coil address 2065
MBOUT_COIL2066	Logic	T/F	State available to Modbus coil address 2066
MBOUT_COIL2067	Logic	T/F	State available to Modbus coil address 2067
MBOUT_COIL2068	Logic	T/F	State available to Modbus coil address 2068
MBOUT_COIL2069	Logic	T/F	State available to Modbus coil address 2069
MBOUT_COIL2070	Logic	T/F	State available to Modbus coil address 2070
MBOUT_COIL2071	Logic	T/F	State available to Modbus coil address 2071
MBOUT_COIL2072	Logic	T/F	State available to Modbus coil address 2072
MBOUT_COIL2073	Logic	T/F	State available to Modbus coil address 2073
MBOUT_COIL2074	Logic	T/F	State available to Modbus coil address 2074
MBOUT_COIL2075	Logic	T/F	State available to Modbus coil address 2075
MBOUT_COIL2076	Logic	T/F	State available to Modbus coil address 2076
MBOUT_COIL2077	Logic	T/F	State available to Modbus coil address 2077
MBOUT_COIL2078	Logic	T/F	State available to Modbus coil address 2078
MBOUT_COIL2079	Logic	T/F	State available to Modbus coil address 2079
MBOUT_COIL2080	Logic	T/F	State available to Modbus coil address 2080
MBOUT_COIL2081	Logic	T/F	State available to Modbus coil address 2081
MBOUT_COIL2082	Logic	T/F	State available to Modbus coil address 2082
MBOUT_COIL2083	Logic	T/F	State available to Modbus coil address 2083
MBOUT_COIL2084	Logic	T/F	State available to Modbus coil address 2084
MBOUT_COIL2085	Logic	T/F	State available to Modbus coil address 2085
MBOUT_COIL2086	Logic	T/F	State available to Modbus coil address 2086
MBOUT_COIL2087	Logic	T/F	State available to Modbus coil address 2087
MBOUT_COIL2088	Logic	T/F	State available to Modbus coil address 2088
MBOUT_COIL2089	Logic	T/F	State available to Modbus coil address 2089
MBOUT_COIL2090	Logic	T/F	State available to Modbus coil address 2090
MBOUT_COIL2091	Logic	T/F	State available to Modbus coil address 2091
MBOUT_COIL2092	Logic	T/F	State available to Modbus coil address 2092
MBOUT_COIL2093	Logic	T/F	State available to Modbus coil address 2093
MBOUT_COIL2094	Logic	T/F	State available to Modbus coil address 2094
MBOUT_COIL2095	Logic	T/F	State available to Modbus coil address 2095
MBOUT_COIL2096	Logic	T/F	State available to Modbus coil address 2096

The MBOUT\_CONFIG constant input parameter is used to define the high-order and low-order byte sequence of register pairs representing 32-bit floating point values.

Constant Input Parameter values are listed in Table 8.

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**Table 8. MBOU\_T\_CONFIG**

Constant Input Parameter	Scale	Lower Value	Upper Value	Typical Value
MBOU_T_CONFIG	T/F	F	T	T

**Fixed Modbus Mapping for the BCM-2**

*Register Map*

In the following Modbus register map (Table 9), the data mapped to the given Modbus register(s) is shown in the Block and Input/Output columns. If the block shown is not present in the configuration file, the value of the Modbus register(s) will be zero (0).

**Table 9. Fixed Modbus Register Map**

Modbus Holding Register	Block	Input/Output Name	Format	Description
41201	TEMP_MONITOR	TM_SCRAP_HS	Floating Point	SCR Phase A-Positive Heat Sink Temperature
41202				
41203	TEMP_MONITOR	TM_AP_JTEMP	Floating Point	SCR Phase A-Positive Junction Temperature
41204				
41205	TEMP_MONITOR	TM_SCRAN_HS	Floating Point	SCR Phase A-Negative Heat Sink Temperature
41206				
41207	TEMP_MONITOR	TM_AP_JTEMP	Floating Point	SCR Phase A-Negative Junction Temperature
41208				
41209	TEMP_MONITOR	TM_SCRBP_HS	Floating Point	SCR Phase B-Positive Heat Sink Temperature
41210				
41211	TEMP_MONITOR	TM_BP_JTEMP	Floating Point	SCR Phase B-Positive Junction Temperature
41212				
41213	TEMP_MONITOR	TM_SCRBN_HS	Floating Point	SCR Phase B-Negative Heat Sink Temperature
41214				
41215	TEMP_MONITOR	TM_BP_JTEMP	Floating Point	SCR Phase B-Negative Junction Temperature
41216				
41217	TEMP_MONITOR	TM_SCRCP_HS	Floating Point	SCR Phase C-Positive Heat Sink Temperature
41218				
41219	TEMP_MONITOR	TM_CP_JTEMP	Floating Point	SCR Phase C-Positive Junction Temperature
41220				
41221	TEMP_MONITOR	TM_SCRCN_HS	Floating Point	SCR Phase C-Negative Heat Sink Temperature
41222				
41223	TEMP_MONITOR	TM_CP_JTEMP	Floating Point	SCR Phase C-Negative Junction Temperature
41224				
41225	TEMP_MONITOR	TM_AIR_TEMP	Floating Point	Ambient Air Temperature

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Modbus Holding Register	Block	Input/Output Name	Format	Description
41226				
41227	Not used			
41228				
41229	Not used			
41230				
41231	CSL	CSL_AP_I	Floating Point	Average Current, during conduction, for Phase A positive thyristor.
41232				
41233	CSL	CSL_AN_I	Floating Point	Average Current, during conduction, for Phase A negative thyristor.
41234				
41235	CSL	CSL_BP_I	Floating Point	Average Current, during conduction, for Phase B positive thyristor.
41236				
41237	CSL	CSL_BN_I	Floating Point	Average Current, during conduction, for Phase B negative thyristor.
41238				
41239	CSL	CSL_CP_I	Floating Point	Average Current, during conduction, for Phase C positive thyristor.
41240				
41241	CSL	CSL_CN_I	Floating Point	Average Current, during conduction, for Phase C negative thyristor.
41242				
41243	CSL	CSL_P_BRG_I	Floating Point	Bridge Current from positive leg of bridge
41244				
41245	CSL	CSL_N_BRG_I	Floating Point	Bridge Current into negative leg of bridge
41246				
41247	CSL	CSL_ISCALE	Floating Point	Bridge Base Current
41248				
41249	Not used			
41250				
41251	Not used			
41252				
41253	RTC_SYNC	RTC_MONTH	Floating Point	Month of Year
41254				
41255	RTC_SYNC	RTC_DAY	Floating Point	Day of Month
41256				

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Modbus Holding Register	Block	Input/Output Name	Format	Description
41257	RTC_SYNC	RTC_YEAR	Floating Point	Year, Number of years since 2000
41258				
41259	RTC_SYNC	RTC_HOUR	Floating Point	Hour of day in 24 hour format
41260				
41261	RTC_SYNC	RTC_MINUTE	Floating Point	Minute of Hour
41262				
41263	RTC_SYNC	RTC_SECOND	Floating Point	Second of Minute
41264				
41265	RTC_SYNC	RTC_FRAC	Floating Point	Tenths of Second
41266				
41267	Not used			
41268				
41269	Not used			
41270				
41271	PLL	PLL_FIRING_CMD	Floating Point	Bridge Firing Command in PU
41272				
41273	PLL	PLL_ANGLE	Floating Point	Bridge firing angle, in degrees
41274				
41275	PLL	PLL_VPPT	Floating Point	Bridge input magnitude in PU
41276				
41277	PLL	PLL_FREQ	Floating Point	Bridge Frequency in Hz
41278				
41279	Not used			
41280				
41281	LINETRN#00	LINETRN00_MAGNITUDE	Floating Point	Voltage input magnitude in PU
41282				
41283	LINETRN#00	LINETRN00_FREQUENCY	Floating Point	Voltage input Frequency in Hz
41284				
41285	LINETRN#01	LINETRN01_MAGNITUDE	Floating Point	Voltage input magnitude in PU
41286				
41287	LINETRN#01	LINETRN01_FREQUENCY	Floating Point	

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Modbus Holding Register	Block	Input/Output Name	Format	Description
41288				Voltage input Frequency in Hz
41289	Not used			
41290				
41291	Not used			
41292				
41293	FTOV#00	FTOV00_OUTPUT	Floating Point	PU Magnitude of signal at FTOV00
41294				
41295	FTOV#01	FTOV01_OUTPUT	Floating Point	PU Magnitude of signal at FTOV01
41296				
41297	FTOV#02	FTOV02_OUTPUT	Floating Point	PU Magnitude of signal at FTOV02
41298				
41299	FTOV#03	FTOV03_OUTPUT	Floating Point	PU Magnitude of signal at FTOV03
41300				
41301	Not used			
41302				
41303	Not used			
41304				
41305	MANADJ	MANADJ_REF	Floating Point	Manual Adjust Reference Value
41306				
41307	MANADJ	MANADJ_TRAVEL	Floating Point	Manual Adjust % Travel
41308				
41309	MAN_MXR	MANMIX_V1	Floating Point	Manual Control Error Signal
41310				
41311	MAN_MXR	MANMIX_ERROR	Floating Point	Active Error Signal Output Magnitude
41312				
41313	Not used			
41314				
41315	Not used			
41316				
41317	OELP#00	OEL00_V4	Floating Point	OEL00 Compensated Field Current in PU
41318				

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Modbus Holding Register	Block	Input/Output Name	Format	Description
41319	OELP#00	OEL00_CNTL_REF	Floating Point	OEL00 Take over style limiter reference input
41320				
41321	OELP#00	OEL00_OUT	Floating Point	OEL00 Limiter Output Signal
41322				
41323	OELP#00	OEL00_OUT2	Floating Point	OEL00 Take over style limiter Output Signal
41324				
41325	Not used			
41326				
41327	Not used			
41328				
41329	OVL_P	OVL_V6	Floating Point	Limiting Voltage Level in PU
41330				
41331	OVL_P	OVL_CNTL_REF	Floating Point	Take over style limiter reference input
41332				
41333	OVL_P	OVL_OUT	Floating Point	Limiter Output Signal
41334				
41335	OVL_P	OVL_OUT2	Floating Point	Take over style limiter Output Signal
41336				
41337	Not used			
41338				
41339	Not used			
41340				
41341	EDM	EDM_HARMONIC	Floating Point	PU Value of harmonic of the field current
41342				
41343	EDM	EDM_RMS	Floating Point	PU value of RMS value of the field current ripple
41344				
41345	Not used			
41346				
41347	Not used			
41348				
41349	OELP#01	OEL01_V4	Floating Point	

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Modbus Holding Register	Block	Input/Output Name	Format	Description
41350				OEL01 Compensated Field Current in PU
41351	OELP#01	OEL01_CNTL_REF	Floating Point	OEL01 Take over style limiter reference input
41352				
41353	OELP#01	OEL01_OUT	Floating Point	OEL01 Limiter Output Signal
41354				
41355	OELP#01	OEL01_OUT2	Floating Point	OEL01 Take over style limiter Output Signal
41356				

### Coil Map

In the following Modbus coil map (Table 10), the data mapped to the given Modbus coil(s) is shown in the Block and Input/Output columns. If the block shown is not present in the configuration file, the value of the Modbus coil(s) will be FALSE (0).

**Table 10. Fixed Modbus Coil Map**

Modbus Coil	Block	Input/Output Name	Format	Description
2101	RTC_SYNC	RTC_NTP_SYNC_FAIL	Binary/Discrete Output	Loss of NTP synchronization signal detected
2102	Not used			
2103	SS	SS_RUNNING	Binary/Discrete Output	Bridge is running
2104	SS	SS_ENABLED	Binary/Discrete Output	LATCH when ON_CMD received
2105	SS	SS_TRIP	Binary/Discrete Output	Bridge is tripped
2106	SS	SS_ALARM	Binary/Discrete Output	Bridge has a alarm
2107	SS	IN Not Zero (Internal)	Binary/Discrete Output	Bridge off and negative bridge current too big - self clearing
2108	SS	IP Not Zero (Internal)	Binary/Discrete Output	Bridge off and positive bridge current too big - self clearing
2109	SS	IBR Not Zero (Internal)	Binary/Discrete Output	Positive or Negative bridge current not zero with bridge off
2110	SS	AC Stuck Closed (Internal)	Binary/Discrete Output	AC bridge breaker stuck closed - Latched
2111	SS	AC Stuck Open (Internal)	Binary/Discrete Output	Ac bridge breaker stuck open - Latched
2112	SS	DC Stuck Closed (Internal)	Binary/Discrete Output	DC breaker stuck closed - Latched
2113	SS	DC Stuck Open (Internal)	Binary/Discrete Output	DC breaker stuck open - Latched
2114	Not used			

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Modbus Coil	Block	Input/Output Name	Format	Description
2115	Not used			
2116	Not used			
2117	DIG_IN	DIGIN_IN1	Binary/Discrete Output	DIG_IN block feedbacks input 1
2118	DIG_IN	DIGIN_IN2	Binary/Discrete Output	DIG_IN block feedbacks input 2
2119	DIG_IN	DIGIN_IN3	Binary/Discrete Output	DIG_IN block feedbacks input 3
2120	DIG_IN	DIGIN_IN4	Binary/Discrete Output	DIG_IN block feedbacks input 4
2121	DIG_IN	DIGIN_IN5	Binary/Discrete Output	DIG_IN block feedbacks input 5
2122	DIG_IN	DIGIN_MAIN	Binary/Discrete Output	DIG_IN block feedbacks input Main
2123	DIG_IN	DIGIN_RED	Binary/Discrete Output	DIG_IN block feedbacks input Red
2124	DIG_IN	DIGIN_CHNL3	Binary/Discrete Output	DIG_IN block feedbacks input Chnl3
2125	Not used			
2126	Not used			
2127	CHNL_SLCT	CHNLSLCT_MAIN_ACTIVE	Binary/Discrete Output	Main Channel Input Active
2128	CHNL_SLCT	CHNLSLCT_RED_ACTIVE	Binary/Discrete Output	Redundant Channel Input Active
2129	CHNL_SLCT	CHNLSLCT_CHNL3_ACTIVE	Binary/Discrete Output	Channel 3 Input Active
2130	CHNL_SLCT	Bad SS (Internal)	Binary/Discrete Output	BAD STATE SELECT INPUT
2131	Not used			
2132	Not used			
2133	FLDTRAN	FLDTRN_F7_BAD	Binary/Discrete Output	Fiber input F7 Out of Range
2134	FLDTRAN	FLDTRN_F8_BAD	Binary/Discrete Output	Fiber input F8 Out of Range
2135	FLDTRAN	FLDTRN_F9_BAD	Binary/Discrete Output	Fiber input F9 Out of Range
2136	FLDTRAN	FLDTRN_F10_BAD	Binary/Discrete Output	Fiber input F10 Out of Range
2137	Not used			
2138	Not used			
2139	Not used			
2140	Not used			

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Modbus Coil	Block	Input/Output Name	Format	Description
2141	TEMP_MONITOR	TM_LOSS_COOLING	Binary/Discrete Output	HEATSINKS ABOVE LOW THRESHOLD AND AIR ABOVE THRESHOLD
2142	TEMP_MONITOR	TM_FAN_FB_ALM	Binary/Discrete Output	FAN FEED BACK NOT PRESENT
2143	TEMP_MONITOR	TM_AIR_ON	Binary/Discrete Output	Fan would be commanded ON based on air temperature
2144	TEMP_MONITOR	TM_HS_ON	Binary/Discrete Output	Fan would be commanded ON based on heat sink temperature
2145	TEMP_MONITOR	TM_AIR_ALARM	Binary/Discrete Output	Any Air based temperature alarm active
2146	TEMP_MONITOR	TM_TJ_ALARM	Binary/Discrete Output	Any Heat Sink based temperature alarm active
2147	TEMP_MONITOR	SCR AP Low Temp Alarm (Internal)	Binary/Discrete Output	PHASE A POSITIVE HEAT SINK LOW TEMP ALARM
2148	TEMP_MONITOR	SCP AP High Temp Alarm (Internal)	Binary/Discrete Output	PHASE A POSITIVE HEAT SINK HI TEMP ALARM
2149	TEMP_MONITOR	SCP AP OFF Alarm (Internal)	Binary/Discrete Output	SCR AP disabled on Hi Temp
2150	TEMP_MONITOR	SCR AN Low Temp Alarm (Internal)	Binary/Discrete Output	PHASE A NEGATIVE HEAT SINK LOW TEMP ALARM
2151	TEMP_MONITOR	SCP AN High Temp Alarm (Internal)	Binary/Discrete Output	PHASE A NEGATIVE HEAT SINK LOW TEMP ALARM
2152	TEMP_MONITOR	SCP AN OFF Alarm (Internal)	Binary/Discrete Output	SCR AN disabled on Hi Temp
2153	TEMP_MONITOR	SCR BP Low Temp Alarm (Internal)	Binary/Discrete Output	PHASE B POSITIVE HEAT SINK LOW TEMP ALARM
2154	TEMP_MONITOR	SCP BP High Temp Alarm (Internal)	Binary/Discrete Output	PHASE B POSITIVE HEAT SINK HI TEMP ALARM
2155	TEMP_MONITOR	SCP BP OFF Alarm (Internal)	Binary/Discrete Output	SCR BP disabled on Hi Temp
2156	TEMP_MONITOR	SCR BN Low Temp Alarm (Internal)	Binary/Discrete Output	PHASE B NEGATIVE HEAT SINK LOW TEMP ALARM
2157	TEMP_MONITOR	SCP BN High Temp Alarm (Internal)	Binary/Discrete Output	PHASE B NEGATIVE HEAT SINK HI TEMP ALARM

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Modbus Coil	Block	Input/Output Name	Format	Description
2158	TEMP_MONITOR	SCP BN OFF Alarm (Internal)	Binary/Discrete Output	SCR BN disabled on Hi Temp
2159	TEMP_MONITOR	SCR CP Low Temp Alarm (Internal)	Binary/Discrete Output	PHASE C POSITIVE HEAT SINK LOW TEMP ALARM
2160	TEMP_MONITOR	SCP CP High Temp Alarm (Internal)	Binary/Discrete Output	PHASE C POSITIVE HEAT SINK HI TEMP ALARM
2161	TEMP_MONITOR	SCP CP OFF Alarm (Internal)	Binary/Discrete Output	SCR CP disabled on Hi Temp
2162	TEMP_MONITOR	SCR CN Low Temp Alarm (Internal)	Binary/Discrete Output	PHASE C NEGATIVE HEAT SINK LOW TEMP ALARM
2163	TEMP_MONITOR	SCP CN High Temp Alarm (Internal)	Binary/Discrete Output	PHASE C NEGATIVE HEAT SINK HI TEMP ALARM
2164	TEMP_MONITOR	SCP CN OFF Alarm (Internal)	Binary/Discrete Output	SCR CN disabled on Hi Temp
2165	Not used			
2166	Not used			
2167	Not used			
2168	Not used			
2169	CSL	CSL_AN_OPEN	Binary/Discrete Output	CONDUCTION SENSOR PHASE A NEGATIVE NOT CONDUCTING
2170	CSL	CSL_AP_OPEN	Binary/Discrete Output	CONDUCTION SENSOR PHASE A POSITIVE NOT CONDUCTING
2171	CSL	CSL_BN_OPEN	Binary/Discrete Output	CONDUCTION SENSOR PHASE B NEGATIVE NOT CONDUCTING
2172	CSL	CSL_BP_OPEN	Binary/Discrete Output	CONDUCTION SENSOR PHASE B POSITIVE NOT CONDUCTING
2173	CSL	CSL_CN_OPEN	Binary/Discrete Output	CONDUCTION SENSOR PHASE C NEGATIVE NOT CONDUCTING
2174	CSL	CSL_CP_OPEN	Binary/Discrete Output	CONDUCTION SENSOR PHASE C POSITIVE NOT CONDUCTING
2175	CSL	CSL_FU_A_FAIL	Binary/Discrete Output	OPEN LINE OR FUSE PHASE A
2176	CSL	CSL_FU_B_FAIL	Binary/Discrete Output	OPEN LINE OR FUSE PHASE B
2177	CSL	CSL_FU_C_FAIL	Binary/Discrete Output	OPEN LINE OR FUSE PHASE C

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Modbus Coil	Block	Input/Output Name	Format	Description
2178	CSL	CSL_CM_A_FAIL	Binary/Discrete Output	A PHASE CONDUCTION SENSOR FAILED
2179	CSL	CSL_CM_B_FAIL	Binary/Discrete Output	B PHASE CONDUCTION SENSOR FAILED
2180	CSL	CSL_CM_C_FAIL	Binary/Discrete Output	C PHASE CONDUCTION SENSOR FAILED
2181	Not used			
2182	Not used			
2183	Not used			
2184	Not used			
2185	FANCTL	FC_FAN_ALARM	Binary/Discrete Output	Fan Alarm
2186	FANCTL	FC_MAIN_STUCK_ON	Binary/Discrete Output	Main Fan Stuck On
2187	FANCTL	FC_MAIN_NOT_ON	Binary/Discrete Output	Main Fan Not On
2188	FANCTL	FC_XFER_TO_MAIN	Binary/Discrete Output	Transfer to Main Fan
2189	FANCTL	FC_BACKUP_NOT_ON	Binary/Discrete Output	Backup Fan Not On
2190	FANCTL	FC_BACKUP_STUCK_ON	Binary/Discrete Output	Backup Fan Stuck On
2191	FANCTL	FC_XFER_TO_BACKUP	Binary/Discrete Output	Transfer to Backup Fan
2192	FANCTL	FC_FAN_ON	Binary/Discrete Output	Either Fan is ON
2193	FANCTL	FC_MAIN_ON	Binary/Discrete Output	Main Fain is On
2194	FANCTL	FC_BACKUP_ON	Binary/Discrete Output	Backup Fain is On
2195	FANCTL	FC_TEST_ON	Binary/Discrete Output	Fan Test in Progress
2196	Not used			
2197	Not used			
2198	Not used			
2199	Not used			
2200	Not used			
2201	RTD_TEMPS	RTD_RTD1_OPEN	Binary/Discrete Output	RTD #1 IS OPEN
2202	RTD_TEMPS	RTD_RTD2_OPEN	Binary/Discrete Output	RTD #2 IS OPEN
2203	RTD_TEMPS	RTD_RTD3_OPEN	Binary/Discrete Output	RTD #3 IS OPEN
2204	RTD_TEMPS	RTD_RTD4_OPEN	Binary/Discrete Output	RTD #4 IS OPEN
2205	RTD_TEMPS	RTD_RTD5_OPEN	Binary/Discrete Output	RTD #5 IS OPEN
2206	RTD_TEMPS	RTD_RTD6_OPEN	Binary/Discrete Output	RTD #6 IS OPEN
2207	RTD_TEMPS	RTD_RTD7_OPEN	Binary/Discrete Output	RTD #7 IS OPEN
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Modbus Coil	Block	Input/Output Name	Format	Description
2208	RTD_TEMPS	RTD_RTD1_SHORTED	Binary/Discrete Output	RTD #1 IS SHORT
2209	RTD_TEMPS	RTD_RTD2_SHORTED	Binary/Discrete Output	RTD #2 IS SHORT
2210	RTD_TEMPS	RTD_RTD3_SHORTED	Binary/Discrete Output	RTD #3 IS SHORT
2211	RTD_TEMPS	RTD_RTD4_SHORTED	Binary/Discrete Output	RTD #4 IS SHORT
2212	RTD_TEMPS	RTD_RTD5_SHORTED	Binary/Discrete Output	RTD #5 IS SHORT
2213	RTD_TEMPS	RTD_RTD6_SHORTED	Binary/Discrete Output	RTD #6 IS SHORT
2214	RTD_TEMPS	RTD_RTD7_SHORTED	Binary/Discrete Output	RTD #7 IS SHORT
2215	Not used			
2216	Not used			
2217	LINETRN#00	LINETRN00_F1	Binary/Discrete Output	LINETRN00 is NOT Locked
2218	LINETRN#01	LINETRN01_F1	Binary/Discrete Output	LINETRN01 is NOT Locked
2219	PLL	PLL_LOCKED	Binary/Discrete Output	PLL is locked
2220	Not used			
2221	MANADJ	MANADJ_F1	Binary/Discrete Output	Reference adjuster at Max
2222	MANADJ	MANADJ_F2	Binary/Discrete Output	Reference adjuster at Min
2223	MAN_MXR	MANMIX_F1	Binary/Discrete Output	Man Error Input in Control of MANMIX Output
2224	MAN_MXR	MANMIX_F2	Binary/Discrete Output	MEL Input in Control of MANMIX Output
2225	MAN_MXR	MANMIX_F3	Binary/Discrete Output	UEL Input in Control of MANMIX Output
2226	MAN_MXR	MANMIX_F4	Binary/Discrete Output	UVL Input in Control of MANMIX Output
2227	MAN_MXR	MANMIX_F5	Binary/Discrete Output	HV Gate in Control of MANMIX Output
2228	MAN_MXR	MANMIX_F6	Binary/Discrete Output	HXL Input in Control of MANMIX Output
2229	MAN_MXR	MANMIX_F7	Binary/Discrete Output	OVL Input in Control of MANMIX Output
2230	MAN_MXR	MANMIX_F8	Binary/Discrete Output	VARL Input in Control of MANMIX Output
2231	Not used			
2232	Not used			

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Modbus Coil	Block	Input/Output Name	Format	Description
2233	OELP#00	OELP00_F1	Binary/Discrete Output	OEL00 Limiter Picked Up
2234	OELP#00	OELP00_F2	Binary/Discrete Output	OEL00 Limiter Timed Out
2235	OELP#00	OELP00_F3	Binary/Discrete Output	OEL00 Proteciton Picked Up
2236	OELP#00	OELP00_F4	Binary/Discrete Output	OEL00 Protection Delay 1 Timed Out (Transfer to Redundant)
2237	OELP#00	OELP00_F5	Binary/Discrete Output	OEL00 Protection Delay 2 Timed Out (Transfer to Manual)
2238	OELP#00	OELP00_F6	Binary/Discrete Output	OEL00 Proteciton Dleay 3 Timed Out (Trip)
2239	OELP#00	OELP00_F9	Binary/Discrete Output	OEL00 Temperature Recalibration Clipped
2240	OELP#00	OELP00_F10	Binary/Discrete Output	OEL00 Pressure Recalibration Clipped
2241	OELP#00	OELP00_F13	Binary/Discrete Output	OEL00 Output Clipped at Maximum
2242	OELP#00	OELP00_F14	Binary/Discrete Output	OEL00 Output Clipped a Minimum
2243	OELP#00	OELP00_F15	Binary/Discrete Output	OEL00 PI Output in Control of OUT2 Output (take-over limiter active)
2244	OELP#00	OELP00_F16	Binary/Discrete Output	OEL00 Control Reference input in Control of OUT2 Output
2245	Not used			
2246	Not used			
2247	OVL_P	OVL_F1	Binary/Discrete Output	OVL Limiter Picked Up
2248	OVL_P	OVL_F2	Binary/Discrete Output	OVL Limiter Timed Out
2249	OVL_P	OVL_F3	Binary/Discrete Output	OVL Protection Picked Up
2250	OVL_P	OVL_F4	Binary/Discrete Output	OVL Protection Delay 1 Timed Out (Transfer to Redundant)
2251	OVL_P	OVL_F5	Binary/Discrete Output	OVL Protection Delay 2 Timed Out (Trip)
2252	OVL_P	OVL_F10	Binary/Discrete Output	OVL Output Clipped at Maximum
2253	OVL_P	OVL_F11	Binary/Discrete Output	OVL Output Clipped a Minimum
2254	OVL_P	OVL_F12	Binary/Discrete Output	OVL PI Output in Control of OUT2 Output (take-over limiter active)

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Modbus Coil	Block	Input/Output Name	Format	Description
2255	OVL_P	OVL_F13	Binary/Discrete Output	OVL Control Reference input in Control of OUT2 Output
2256	Not used			
2257	Not used			
2258	EDM	EDM_F1	Binary/Discrete Output	Open diode protection picked up
2259	EDM	EDM_OD_TRIP	Binary/Discrete Output	Open diode protection trip timed out
2260	EDM	EDM_F2	Binary/Discrete Output	Shorted diode protection picked up
2261	EDM	EDM_SC_TRIP	Binary/Discrete Output	Shorted diode protection trip timed out
2262	Not used			
2263	Not used			
2264	OELP#01	OELP01_F1	Binary/Discrete Output	OEL01 Limiter Picked Up
2265	OELP#01	OELP01_F2	Binary/Discrete Output	OEL01 Limiter Timed Out
2266	OELP#01	OELP01_F3	Binary/Discrete Output	OEL01 Protection Picked Up
2267	OELP#01	OELP01_F4	Binary/Discrete Output	OEL01 Protection Delay 1 Timed Out (Transfer to Redundant)
2268	OELP#01	OELP01_F5	Binary/Discrete Output	OEL01 Protection Delay 2 Timed Out (Transfer to Manual)
2269	OELP#01	OELP01_F6	Binary/Discrete Output	OEL01 Protection Delay 3 Timed Out (Trip)
2270	OELP#01	OELP01_F9	Binary/Discrete Output	OEL01 Temperature Recalibration Clipped
2271	OELP#01	OELP01_F10	Binary/Discrete Output	OEL01 Pressure Recalibration Clipped
2272	OELP#01	OELP01_F13	Binary/Discrete Output	OEL01 Output Clipped at Maximum
2273	OELP#01	OELP01_F14	Binary/Discrete Output	OEL01 Output Clipped at Minimum
2274	OELP#01	OELP01_F15	Binary/Discrete Output	OEL01 PI Output in Control of OUT2 Output (take-over limiter active)
2275	OELP#01	OELP01_F16	Binary/Discrete Output	OEL01 Control Reference input in Control of OUT2 Output
2276	Not used			

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Modbus Coil	Block	Input/Output Name	Format	Description
2277	Not used			

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