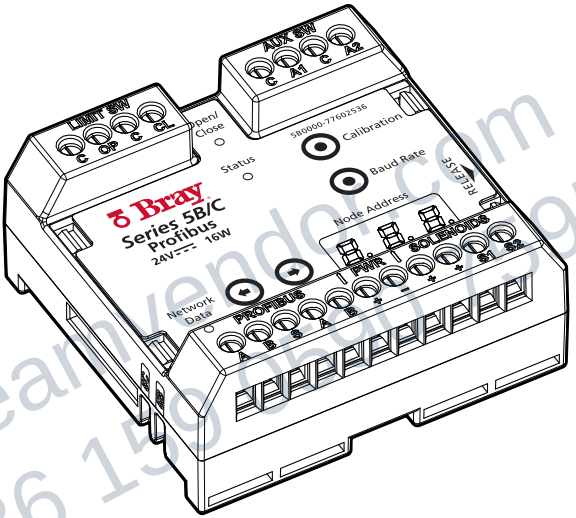
SERIES 5B/C

VALVE STATUS MONITOR PROFIBUS DP

Installation, Operation and Maintenance Manual



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1.0 INTRODUCTION

The Bray Series 5B/C (S5B/C) Valve Status Monitor (VSM) with Communication Protocol electronics (CommPro) is an intelligent switchbox device that provides both position feedback and diagnostic information for discrete valves. It accomplishes this by interfacing with a bus network, over which commands can be sent and feedback can be returned. Once connected to the network, the Bray S5B/C VSM with CommPro becomes part of a larger system, which is required to ensure proper operation of the device. To refer to the elements of the system, a common terminology is used throughout this document, as defined below.

Definition of Terms

- **CommPro –** Bray S5B/C Valve Status Monitor with PROFIBUS DP Communication Protocol module
- **Valve –** Discrete valve being monitored by the CommPro module
- **Process Controller –** Device acting as the network master that communicates with the S5B/C via the CommPro module.

2.0 DESCRIPTION OF OPERATION

The function of the CommPro is to monitor the state of mechanical switches operated by a rotating cam shaft internal to the VSM. This cam shaft is set to trip the switches when the valve travel limits have been reached. Operation of the valve position can be controlled by the process, or the CommPro can operate the valve to the travel limits using solenoid valves. This operational capability, coupled with the position monitoring, gives the CommPro the ability to report degraded or erroneous operation to the Process Controller based on calibration procedures performed at the factory or on-site.

Every CommPro has been designed to communicate using a specific communication protocol, designated by the part number.

- **PROFIBUS DP:** 5B-0000-77602-536

WARNING

If CommPro is installed in S5C VSM, refer to S5C IOM for additional requirements.

NOTICE

Operating the CommPro outside the operational constraints defined in this manual may impair the protection provided by the equipment.

3.0 HARDWARE DESCRIPTION

- One terminal strip (11 terminals) for field connections
- Two terminal strips (4 terminals each) for factory wiring of position switches
- LED User Interface
  - Green Network Data LED
  - Seven segment Red Node Address LED indication
  - Bi-color Red/Blue Product Status LED
  - Bi-color Red/Green Open/Close Position LED
- Parameter switches
  - Calibration switch
  - Baud Rate switch
  - Node Address adjustment switches

3.1 Field Connection Terminals

Each CommPro has 11 terminals dedicated to field connections. These terminals are where the bus connections are made, where external power is provided (if needed), and the load connections are terminated.

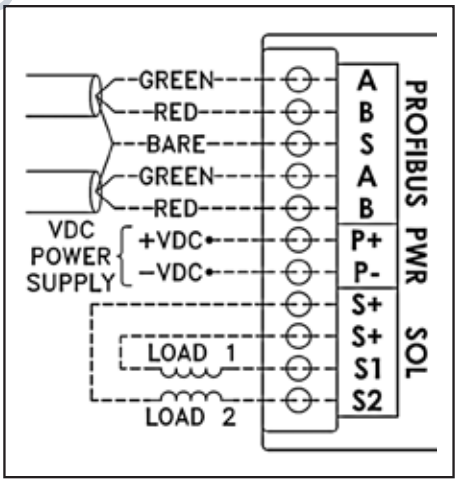

Figure 1: Field wiring of the CommPro

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3.1.1 PROFIBUS DP Connections

The CommPro can be provided with bus connections, eliminating the need for intrusion into the enclosure. The connections come in 2 configurations:

- 2 M12 connectors, Male and Female, in a single conduit entry. This configuration allows the CommPro to be installed in the main segment without the need for a stub.
- Tee connection to an M12 Female connector mounted in the VSM enclosure. This allows for the CommPro to be removed from the bus without interrupting bus communication.

NOTICE

Stub lines (T-pieces) are branches off the main segment. Stub lines are never allowed when bit rates more than 1.5 Mbit/s are used.

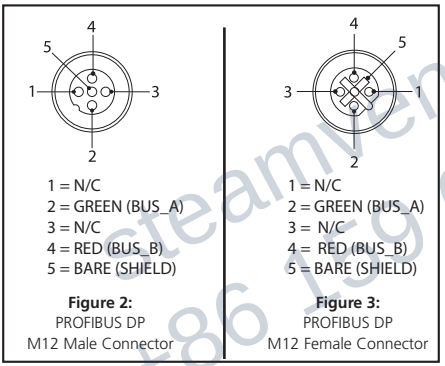

Figure 2: PROFIBUS DP M12 Male Connector

Figure 3: PROFIBUS DP M12 Female Connector

3.1.2 Power Supply

For PROFIBUS DP, power is not provided in the communication cable, therefore an external power connection is required to energize the CommPro module.

The power supply must provide 24VDC ± 10%, and must power the CommPro module along with any load connections. If the maximum output load is needed (13.8W), then the power supply should be able to supply at least 750mA. Since this is a DC connection, it is important that proper polarity is maintained when making this connection.

3.1.3 Load Connections

The CommPro is designed to operate up to two inductive loads at 24VDC. The product was specifically designed and tested to operate two 6.9W solenoid valves; however, any resistive or inductive load of equal or lesser wattage could be operated from this connection.

Each load connection has a wattage limit of 6.9W, and the CommPro has a total wattage limit of 13.8W. Exceeding these limits will result in a fault state. All loads are operated discretely (on/off) using 24VDC. Since these are DC connections, it is important that proper polarity is maintained when making these connections.

3.2 Factory Connection Terminals

Two terminal strips, located on the opposite side of the CommPro from the field connection terminals, are provided for making factory installed terminations. It is at these terminals that the position monitoring switches are connected.

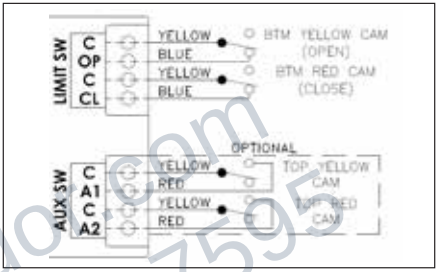

Figure 3: Factory wiring of the CommPro module

3.2.1 Limit Switches

The switches attached to this terminal strip have been set at the factory to be engaged when the travel limits have been reached, fully open and fully closed. The CommPro relies on this position feedback to report position to the Process Controller. If the switches are not being engaged at the fully open and close positions, the cams on the indicator shaft should be adjusted to ensure proper operation. If both switches are engaged at the same time, a fault state will occur.

3.2.2 Optional Auxiliary Switches

Auxiliary switches allow for custom indication to be provided to the Process Controller. The cams that engage the auxiliary switches can be positioned to any position desired in the field, as these switches do not affect standard operation of the CommPro.

3.3 LED Description

3.3.1 Network Data LED

The Network Data LED indicates when the device enters Data Exchange with the network. The default state of the LED is on, and it turns off through the duration of the Data Exchange.

3.3.2 Node Address

Node Address displays the current address of the CommPro module. For PROFIBUS DP, a valid address must be assigned to the CommPro by the user before bus communication can begin.

Default Address
PROFIBUS DP: 126

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3.3.3 Product Status

The bi-color (Red/Blue) LED indicates normal operation by cycling the blue LED on and off every second. In the event of a fault state, the indicator will alternate between red and blue every second. To clear the fault state, the Calibration Switch must be pressed to retest any load connections.

The possible faults that can occur are:

- Limit Switch Fault – Both limit switches engaged at the same time.
- Solenoid Overload – One of the load connections is drawing too much current.
- VSM Overload – The total output load is too large for the CommPro.

3.3.4 Open/Close

The bi-color (Red/Green) LED indicates the current position of the VSM, based on the limit switch state. When in the open position, the green LED is on; when in the close position, the red LED is on.

3.4 User Switches

3.4.1 Calibration Switch

Switch that enters the CommPro into an automated test of its output connections. Both outputs are individually and quickly cycled (< 0.1s on time), which allows for the power draw of each load to be measured. In the event of excessive power draw at one or both load connections, a fault state will be entered.

If a fault state is active, then the Calibration Switch should be pressed for the load(s) to be retested. This ensures that the fault condition has been corrected by the user.

3.4.2 Baud Rate Switch

For the S5B/C PROFIBUS DP, this switch is inactive.

3.4.3 Node Address Switches

Switches that allow the address of the CommPro to be adjusted. When either of these buttons are pressed, the node address display will begin flashings, indicating that it is adjustable. Pressing one of the switches while the node address display flashes will cause the address to increment or decrement, dependent on which switch is pressed. Holding one of the switches while the node address display flashes will automatically increment the node address every 0.25 seconds. Once the desired address has been selected, the node address switches should not be pressed for at least 3 seconds. In that time, the CommPro will set the address to the new value.

Valid Address Range
PROFIBUS DP: 0-126

4.0 PROFIBUS DP INTERFACE

4.1 Node Address

When adding the CommPro to a PROFIBUS DP network, it must have a unique node address. The CommPro ships with a node address of 126, which is the default address for a new device. If the CommPro is added to a network with an address that does not match the address programmed into the Process Controller, then it will not be able to enter Data Exchange. The unit must have its address adjusted, via the Node Address Switches. The CommPro does not support SAP 37, Change Station Address.

4.2 Parameterization and Configuration

Once a slave address has been recognized by the Process Controller, it waits for a parameterization message from the Process Controller, SAP 3D. This message identifies the master to the slave and defines the communication parameters that the slave must use on the network.

With the parameterization telegram accepted by the slave, it awaits a configuration message from the Process Controller, SAP 3E. This message defines the format of the input and output messages during cyclic data exchange, including length and composition. If configuration is successfully completed, then the slave will enter the data exchange state.

If at any point an error is present in the parameterization or configuration data received by the CommPro, a diagnostic message will be sent to the Process Controller, SAP 3C, informing it of the erroneous message, and the slave will return to the parameterization step, where it will wait for a corrected message.

The information that the Process Controller needs to complete parameterization and configuration with the CommPro is contained in the GSD file for the product.

4.2.1 GSD File

A GSD file is an external file that contains information about configurable attributes for a field device in a standardized format that is recognized by bus masters regardless of manufacturer or construction.

The GSD file is included with the CommPro to aide in the installation of the slave into the application, reducing time to operation and simplifying the installation process. The Process Controller will use the GSD to automatically obtain the data that is required to enter Data Exchange, making parameterization and configuration completely transparent to the user.

Depending upon the application that is used to

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associate the GSD with the CommPro, features such as monitoring are available which provide the user with continuously updated bus data that is provided in an easy-to-read format.

4.3 Data Exchange

The CommPro is a DP-V0 device, meaning that it supports cyclic data exchange with a class 1 master, termed an MS0 connection. This connection has a fixed length and is defined in the GSD file provided with the unit. All data exchange with the CommPro occurs cyclically with the default SAP.

4.3.1 Cyclic Messaging

Every bus cycle, the Process Controller transmits output data to the CommPro, which will respond with a transmission of input data back to the Process Controller. If the output data changes, the CommPro will respond to the updated command state after sending the latest response telegram. Due to the high baud rates available to Profibus DP, it is possible that several bus cycles will pass before the slave has reached the desired command state.

Input and output data message composition, relative to the Process Controller, are shown below. Format and length of the data is fixed by the GSD file, and should not be altered by the user.

Input Data		
Size		1 byte
Description		Provides position & status information to the Process Controller
Composition		**2211AALL**
22	2 bits	Load 2 State 00 – No load detected (Open circuit) 01 – Normal load detected 10 – Channel overloaded 11 – Short Circuit
11	2 bits	Load 1 State 00 – No load detected (Open circuit) 01 – Normal load detected 10 – Channel overloaded 11 – Short Circuit
AA	2 bits	Auxiliary Switch State 00 – Auxiliary Switches off 01 – Auxiliary Switch 1 engaged 10 – Auxiliary Switch 2 engaged 11 – Both Auxiliary Switches engaged
LL	2 bits	Limit Switch State 00 – Limit Switches off 01 – Open Limit Switch engaged 10 – Close Limit Switch engaged 11 – Both Limit Switches engaged

Output Data		
Size		1 byte
Description		Command data used to position the S5B/C PROFIBUS DP
Composition		**XXPPFECC**
XX	2 bits	Not used
PP	2 bits	Communication Failure Position If the CommPro exits Data Exchange, then this is the default position until Data Exchange is re-entered. 00 – All loads off 01 – Load 1 on 10 – Load 2 on 11 – All loads on
F	1 bit	Communication Failure Detection Enable Determines if the Communication Failure Position is enabled 0 – Failure Detect Off 1 – Failure Detect On
E	1 bit	Enter Calibration 0 – No action 1 – Begin load calibration
CC	2 bits	Command Position 00 – All loads off 01 – Load 1 on 10 – Load 2 on 11 – All loads on

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5.0 QUICK START GUIDE

1. If installation of the CommPro is required, follow the Installation Instructions.
2. If necessary, load the GSD file into the Process Controller.
3. Apply power to the CommPro power supply. The CommPro will individually illuminate all LEDs as part of the initialization procedure. Initialization is complete once the Network Data light is solid green.
4. Adjust the CommPro Node Address to the next available address on the bus, or to the address that has been programmed into the Process Controller.
5. Once the PROFIBUS DP network is active, the Network Data light should turn off. This indicates successful parameterization and configuration.
6. Press the Calibration switch to detect the state of the connected output loads.
7. Product is ready for service.

6.0 INSTALLATION INSTRUCTIONS

1. Before beginning installation of the electronics package, install all external cabling at the conduit entries for the Bray VSM enclosure. Unused conduit entries should retain the supplied plugs.
2. Install all ground wires to the Bray VSM enclosure supplied ground screw(s).
3. Install the supplied electronics package mounting bracket using the supplied mounting hardware, e.g. flathead screws.
4. Orient the electronics package such that the 11 terminals are orientated towards the front of the Bray VSM.

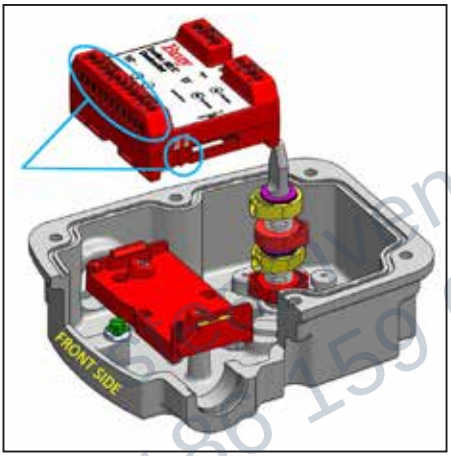

Figure 4: Correct orientation of the electronics package relative to Bray VSM and mounting bracket

5. Align the side slot on the electronics package with the notch on the mounting bracket, based on the Bray VSM (5B or 5C) that it is being installed in.

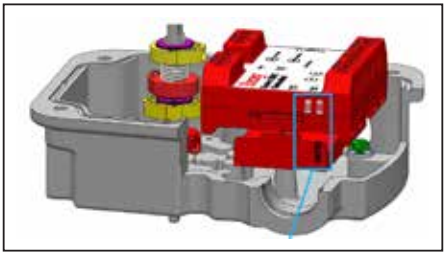

Figure 5: Alignment of appropriate slot

6. Pitch the electronics unit during installation to engage the horizontal slot on the electronics package with the non-adjustable hook of the mounting bracket.

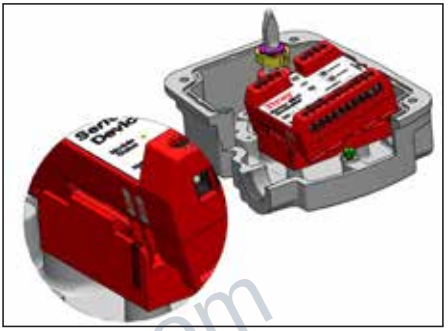

Figure 6: Pitching of the electronics package to begin installation

7. Push down on the electronics package to snap it into place on the mounting bracket.

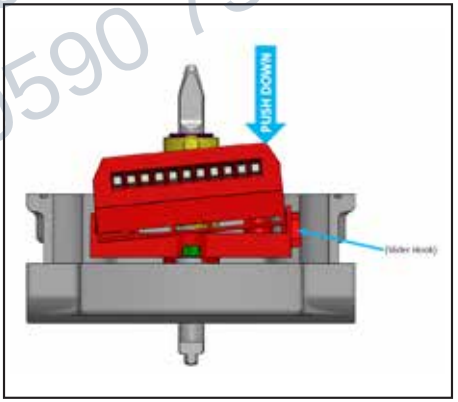

Figure 7: Push down on electronics package until the slider hook snaps in place

8. Mate all required wire terminations based on the provided wiring diagram.

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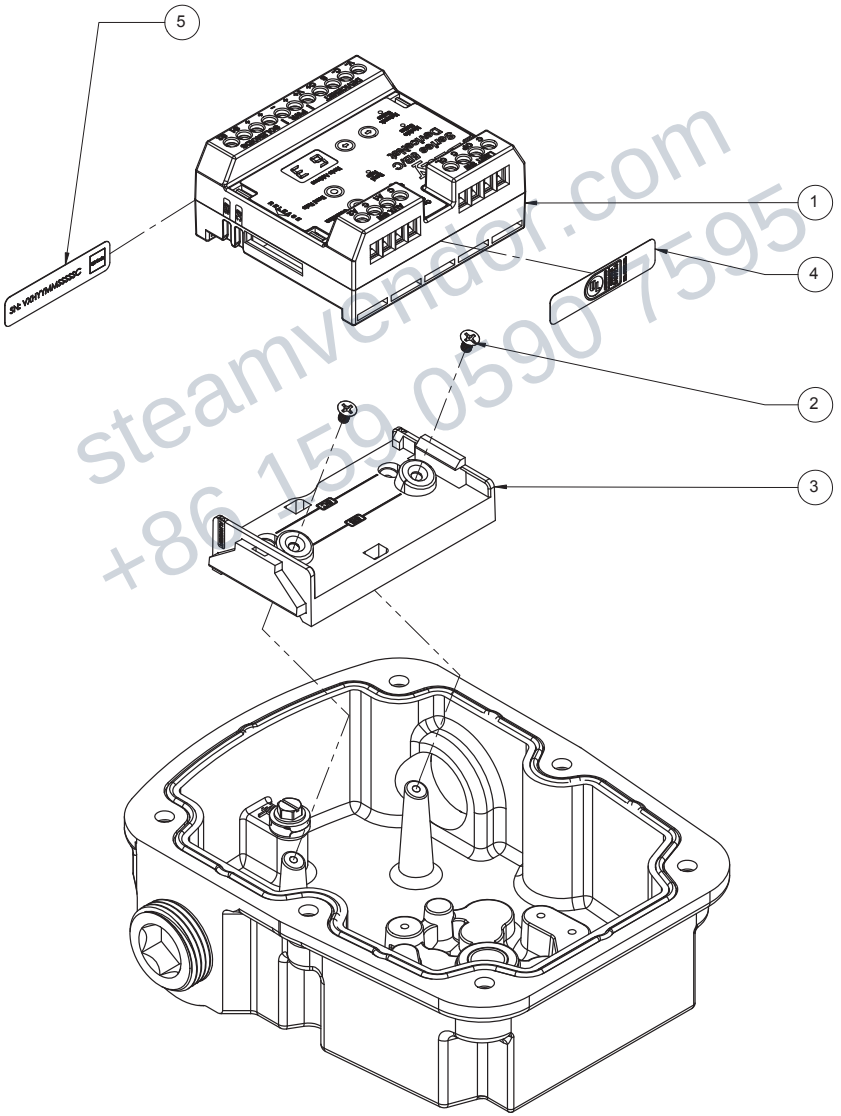
7.0 EXPLODED VIEW DRAWINGS

7.1 Exploded View - 5B

ITEM	PART NUMBER	DESCRIPTION	QTY
1	5B0000-77602536	CommPro Assembly, Profibus-DP	1
2	075303-72105534	Screw, Flat Head, X-Drive	2
3	5B0000-23500536	Commpro Adapter Assembly	1
4	5B0000-73306533	Commpro Certification Label, Mylar	1
5	5B0000-73304533	Commpro Serial Tag, Mylar	1
ALTERNATIVE COMPONENTS			
1	5B0000-77601536	CommPro Assembly, AS-i	1
1	5B0000-77600536	CommPro Assembly, DeviceNet	1



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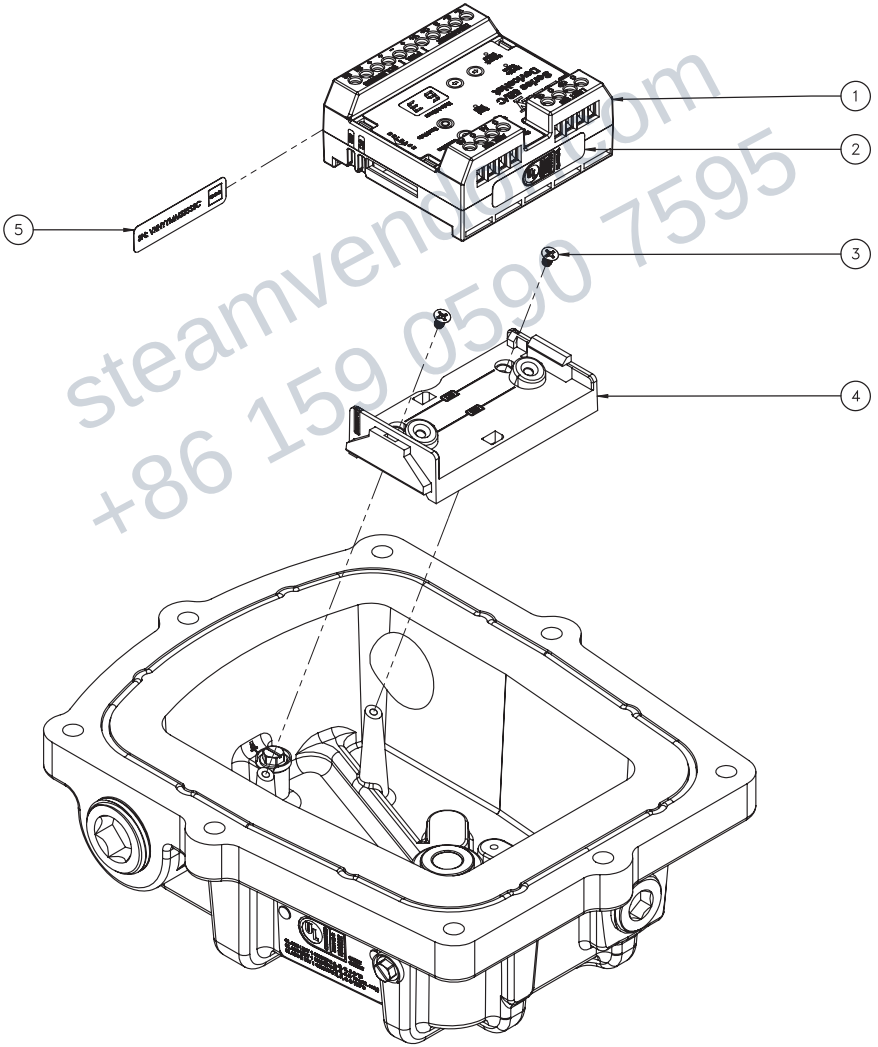
7.2 Exploded View - 5C

ITEM	PART NUMBER	DESCRIPTION	QTY
1	5B0000-77602536	CommPro Assembly, Profibus-DP	1
2	5B0000-73306533	CommPro Certification Label, Mylar	1
3	075303-72105534	Screw, Flat Head, X-Drive, M3x0.5x5mm	2
4	5B0000-23500536	CommPro Adapter Assembly	1
5	5B0000-73304533	CommPro Serial Tag, Mylar	1
ALTERNATIVE COMPONENTS			
1	5B0000-77601536	CommPro Assembly, AS-i	1
1	5B0000-77600536	CommPro Assembly, DeviceNet	1



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8.0 TECHNICAL SPECIFICATIONS

Mechanical	
Electronics Enclosure Material	PC/ABS Blend
Mounting Bracket Material	Glass-filled Nylon
Dimensions with bracket	3.05" x 2.53" x 1.43" [77.5 x 64.3 x 36.3mm]
Dimensions w/o bracket	2.73" x 2.53" x 1.21" [69.3 x 64.3 x 30.7mm]
Weight	Max 3.5 oz [100g]
Terminals	
Wire Gauge	26-16 AWG [0.13-1.31 mm2]
Torque Limit	3.5 in-lbs [15.6 N]
Temperature Rating	-25 to 65°C
Installation	Designed for use within Bray VSMs
Switch connections	Only switches approved for use within Bray VSMs should be used with the product

Electrical	
Input Voltage	24 VDC ± 10%
Power Consumption	16 W Max
Load(s)	24 VDC Solenoids
# of Load Connections	2 Max
Load Switch	Solid-State (NMOS Open-Drain)
Load Limit	6.9 W per load 13.8 W max
LED Wavelengths	
Red	630 nm
Green	550 nm
Blue	470 nm

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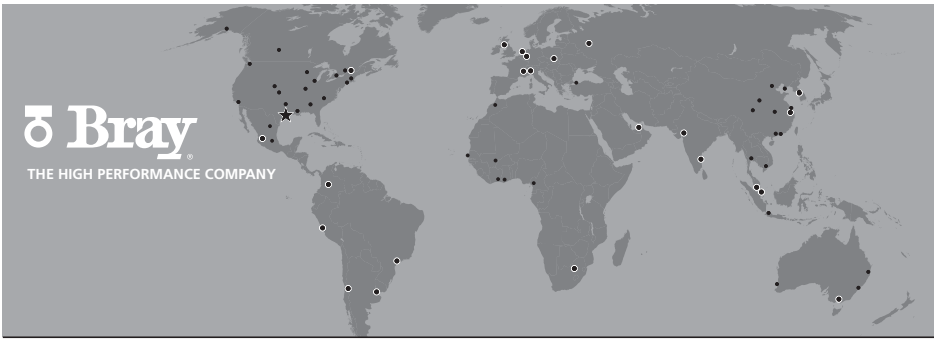

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