rotork®
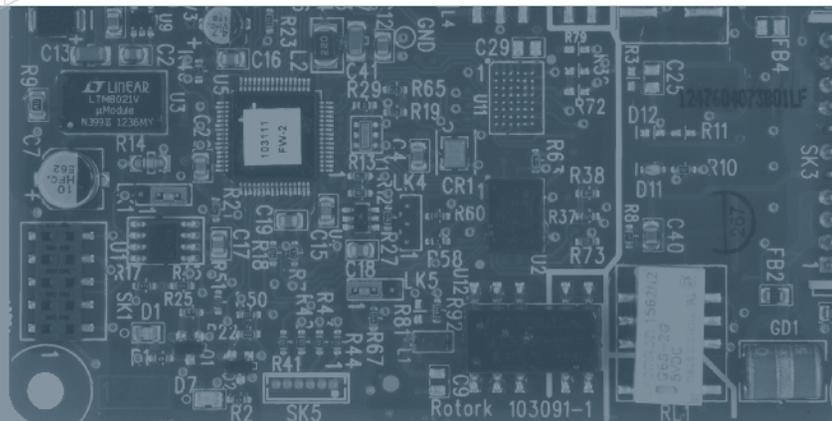
Profibus Actuator Control

PROFI BUS®

Serial communication and control of Rotork actuators

Redefining Flow Control

Contents

Rotork is the global market leader in valve automation and flow control. Our products and services are helping organisations around the world to improve efficiency, assure safety and protect the environment.

We strive always for technical excellence, innovation and the highest quality standards in everything we do. As a result, our people and products remain at the forefront of flow control technology.

Uncompromising reliability is a feature of our entire product range, from our flagship electric actuator range through to our pneumatic, hydraulic and electro-hydraulic actuators, as well as instruments, gearboxes and valve accessories.

Rotork is committed to providing first class support to each client throughout the whole life of their plant, from initial site surveys to installation, maintenance, audits and repair. From our network of national and international offices, our engineers work around the clock to maintain our position of trust.

Rotork. Redefining flow control.

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Introduction

Profibus®-DP serial communication is ideally suited to the control of Rotork actuators. A network using Profibus-DP provides a cost-effective method for connecting actuators in any location to a central control system simply and efficiently.

The Profibus-DP network can operate over a range of communication speeds and provides the mechanism for control of the actuator and feedback of data about the valve.

The Rotork Profibus-DP option cards support standard DP-V0 cyclic data exchange and DP-V1 acyclic data exchange used for diagnosis, set-up and historical data.

The provision of EDD files allows the Siemens PDM utilities to be used during configuration whilst the certified DTM file allows the non-proprietary FDT utility to be used. The standard GSD files allow all complexities of the system, including basic, to be set up.
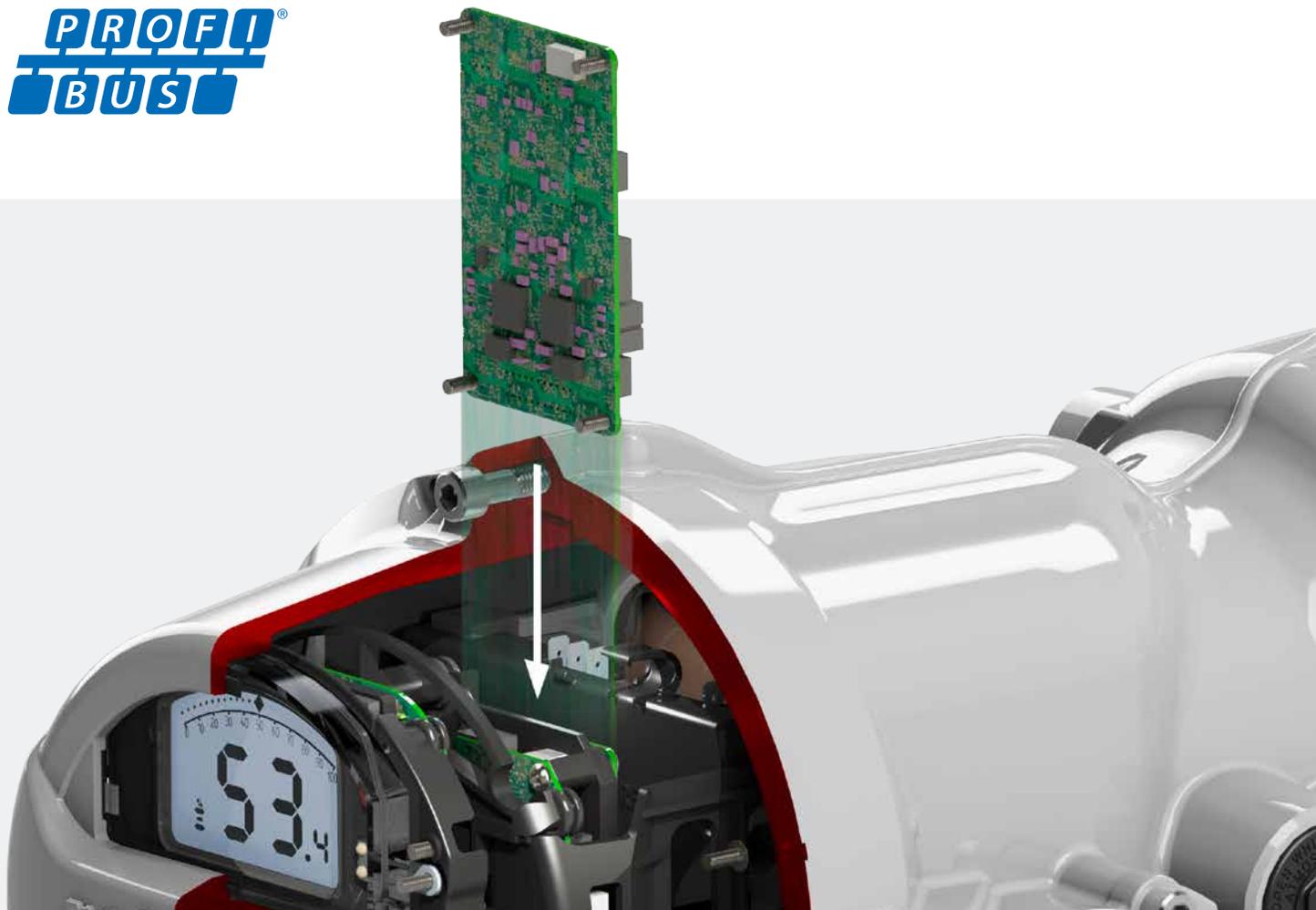
Profibus Overview

- International Open Standard IEC61158 / EN50170

- Suitable for RS-485 Profibus DP bus

- DP-V0 cyclic and DP-V1 acyclic compliant

- Highly reliable standardised communications

- Low installation and maintenance costs, high control system flexibility

- Data transfer between 9600 baud and 1.5 Mbaud

- Support for Simple Dual Channel Redundancy

- Support for RedCom redundancy to PNO specification 2.212

- Support for Process Device Manager (PDM) and Field Device Tool (FDT) utilities

- GSD, EDD and DTM device description files available

- Three versions of the device: Single Channel, Simple Dual Channel and Dual Channel with RedCom compliance

For more information on Profibus® consult the website at http://www.Profibus.com. Profibus is supported by leading PLC manufacturers such as Siemens and Mitsubishi.

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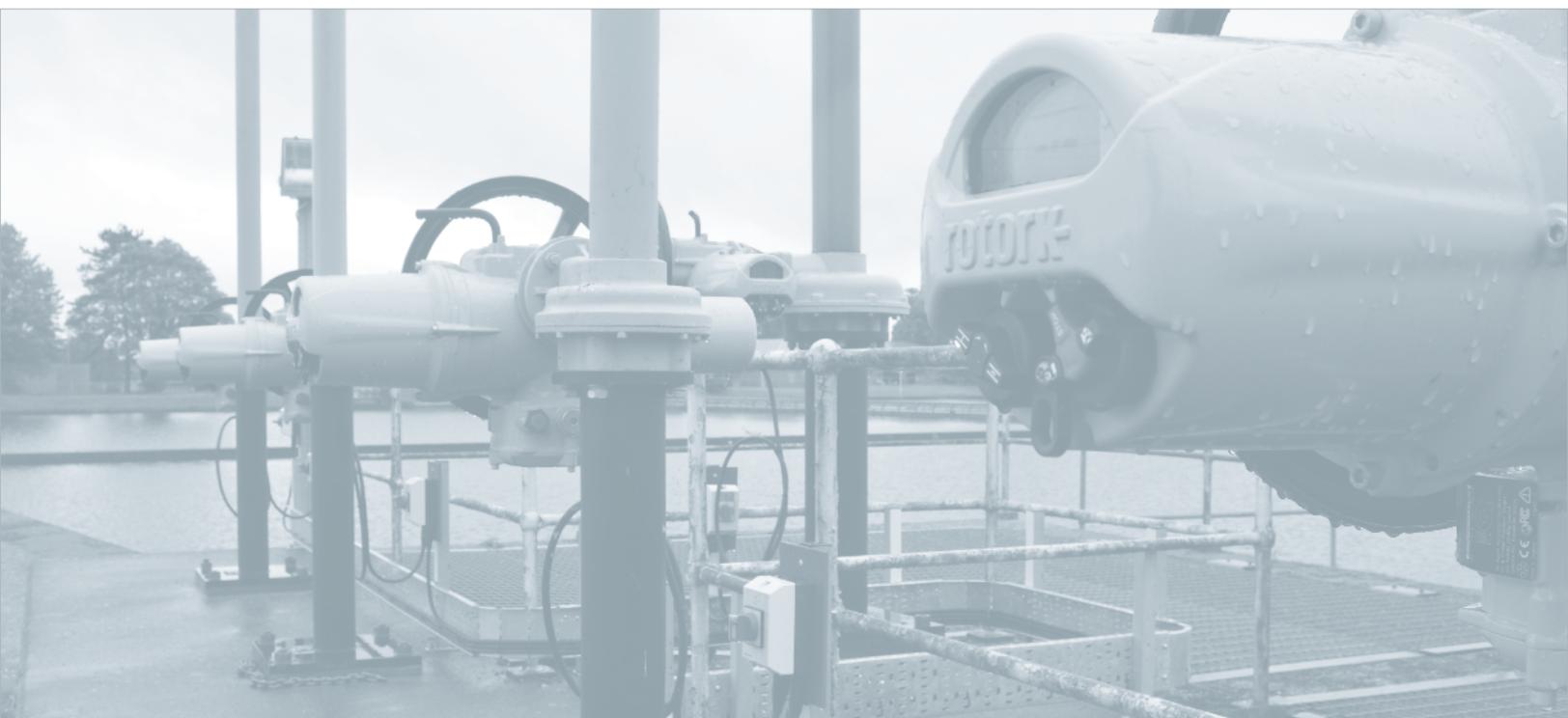
Profibus Features

Profibus DP-V1 module

The Profibus module is fitted inside the actuator electrical housing and interfaces directly with the actuator electronics. Once fitted, all the normal commands associated with moving the actuator, together with feedback and some historical data become available on the Profibus DP, RS-485 highway.

There are a number of user settings to be made for the system variables and actuator performance, such as the slave address of the actuator. These are set by either using the appropriate infra-red or *Bluetooth*® enabled tool for actuators that have the facility or by parameterising over the network to the appropriate registers in the module using a suitable tool.

The GSD file can be edited in a simple text editor to modify the internal parameters during Profibus start-up. All the settings are held in non-volatile EEPROM memory on the card.

Profibus DP Communication Highway

The Profibus DP module is a slave device supporting normal cyclic communication with the PLC using V0 communication and also supporting acyclic communication using V1 communication.

The Profibus highway uses RS-485, 2-wire communication. Up to 126 devices can be connected on a single network provided suitable repeaters are included. Without repeaters only 32 devices, including the PLC, are allowed. Address 126 is reserved for a new device appearing on the highway.

PLC	Address 1	Address 2	Address 3

1,000 metres at 9,600 baud
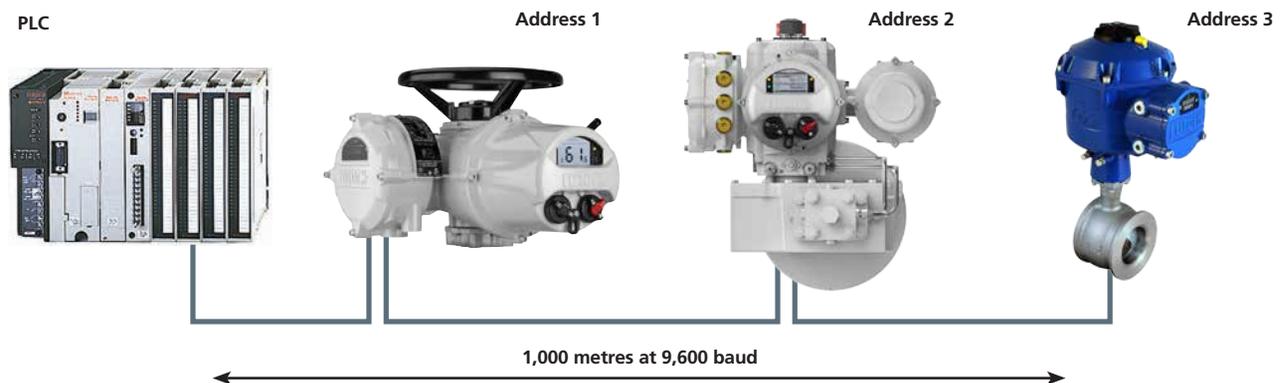
Data Rate (baud)	9600	19200	93.75k	187.5k	500k	1.5M
Maximum Segment Length	1 km	1 km	1 km	1 km	400 m	200 m
Maximum Highway Length	10 km	10 km	10 km	10 km	4 km	2 km
Max No. of actuators/segment	31	31	31	31	31	31

**Note:**   Each actuator internal wiring is arranged so that the stub length is zero. Calculations are based on Type A Profibus cable.

Redefining Flow Control

Profibus Features

Profibus Single Channel Module

The single channel option is the simplest implementation of the Profibus Module. The actuator is connected to one highway only. Two pairs of data highway terminals are provided to ensure zero stub length inside the actuator.

Single highway systems provide the maximum cost/benefit to the installer. There is only one cable, so the hardware and installation are minimised. In addition, the engineering involved with a single channel system is simpler.
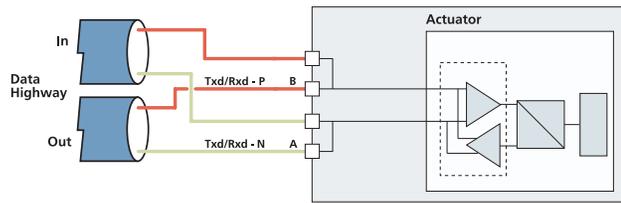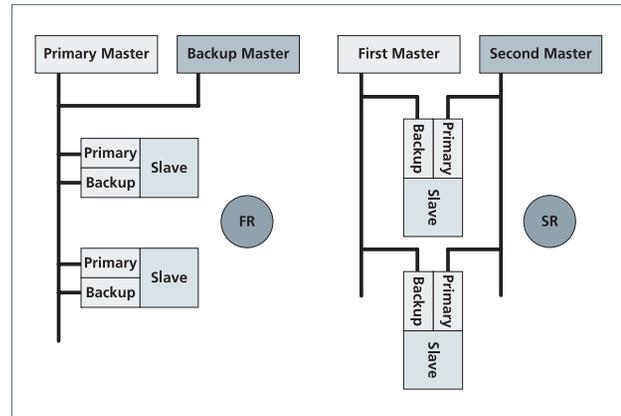
Profibus Dual Channel Modules

Although two highways are used there is only a marginal additional cost for the increased availability of the plant. There is a small increase in the field hardware and installation costs which is often acceptable when viewing the overall plant requirements.

The Profibus module has two Profibus interface chips that allow for two communication channels and redundancy either by two highways (SR System Redundancy) or a single highway (FR Flying Redundancy).

The two versions of the Profibus module that cater for redundant communication ensure that both simple dual PLC and fully integrated redundant PLC configurations can take advantage of system and flying redundancy.
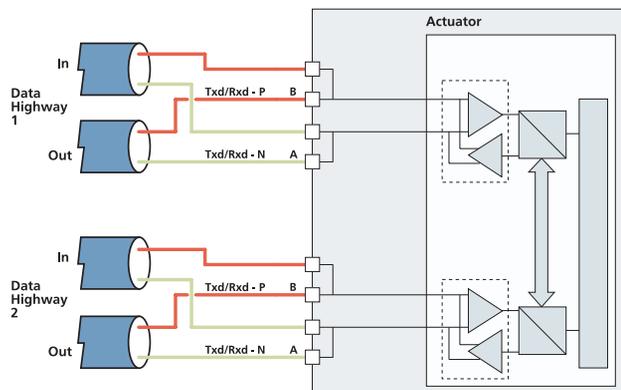
Simple Dual Channel Module

The simple dual channel version caters for those applications where redundant highways are being used and the host PLC does not support a full RedCom system. The two channels are isolated from one another and provide redundant communication paths without including the special functions required by RedCom. This module is the ideal choice for redundant control when the PLCs do not have the capability to support full RedCom facilities.

RedCom Dual Channel Module

For those systems able to support the Profibus redundant standard, the RedCom Dual Channel Module is fully compliant with PNO specification 2.212. As with the simple dual channel module, the RedCom module is able to support DP-V0 cyclic communication, DP-V1 acyclic communication, additionally the RedCom module also supports the extensions to the V1 protocol that allow the full PNO redundant specification to be implemented.

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Profibus Features

Redundant Communications – Simple and RedCom Operation

RedCom compliant PLCs and systems require extended diagnostic messages that can be a nuisance to ordinary simple PLCs. The Profibus Dual Channel module switches modes between simple and fully RedCom compliant applications simply by changing a parameter set by the GSD file.

Both versions will automatically switch Primary to Backup and Backup to Primary when searching for communication. This switching will also occur whenever communications on the primary channel is lost. Communication always takes place with a channel in Primary mode.

RedCom is only suitable for use with compliant PLC systems.

- SR and FR redundancy modes supported

- Fully supports extensions to Profibus protocol for RedCom support

- Primary and Backup slaves inside the Profibus module exchange parameterisation data

- In FR mode the backup slave address is offset by 64

Device Description Files

The Rotork Profibus module is provided complete with Device Description files for 3 methods of configuration. The files can be downloaded from the Profibus literature page on the rotork website. The standard GSD files supported by all Profibus Class 1 masters and MS0 cyclic communication services are augmented by the EDD files used by PDM and by DTM files, as used by FDT utilities.
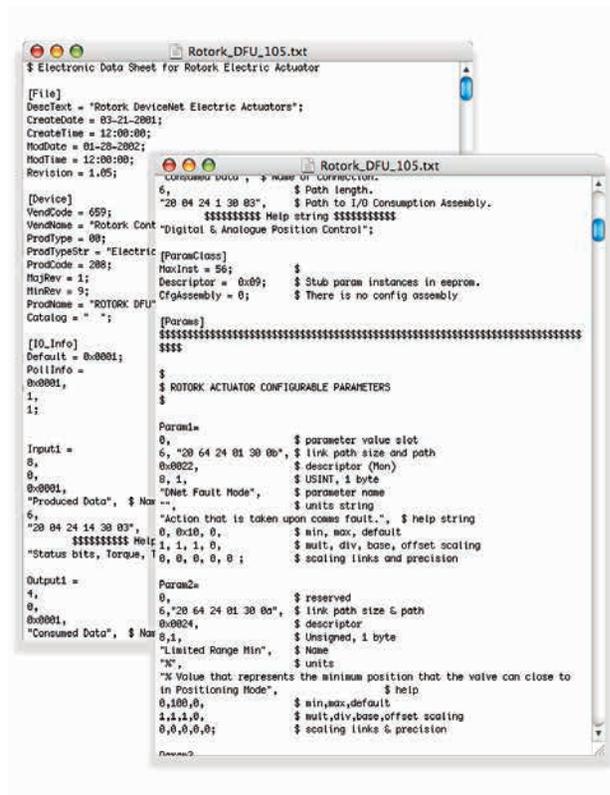
FDT – Field Device Tool

FDT (Field Device Tool) technology standardises the communication interface between field devices and systems. The utility allows off-line or on-line configuration of a Profibus network and preparation of download files for Profibus devices. In order to create the specific application each device on the network is required to have a device description file called a DTM – Device Type Manager. The Rotork Profibus Module DTM allows all the settings for the Profibus card to be made and torque profiles and settings to be viewed.

PDM – Process Device Manager

PDM is a Siemens utility which is very similar to FDT and allows the Profibus network to be configured on- or off-line. The individual Profibus devices each require a special Electronic Device Description (EDD) file to be used by the utility. The Electronic Device Description Language (EDDL) conforms to the CENELEC Standard EN50391 and EDD is a standard for PROFIBUS. The Rotork Profibus Module EDD allows all the settings for the card to be made and also allows control and monitoring. In addition, torque profiles and settings can be viewed.

GSD – Standard Device Description Tool

The GSD data file allows for parameterisation of the Profibus module from any host PLC using cyclic V0 communication. This includes the selection of the Module Configuration parameter that selects the data registers to exchange in cyclic mode. Three GSD files are available, one for the each of the three module types.
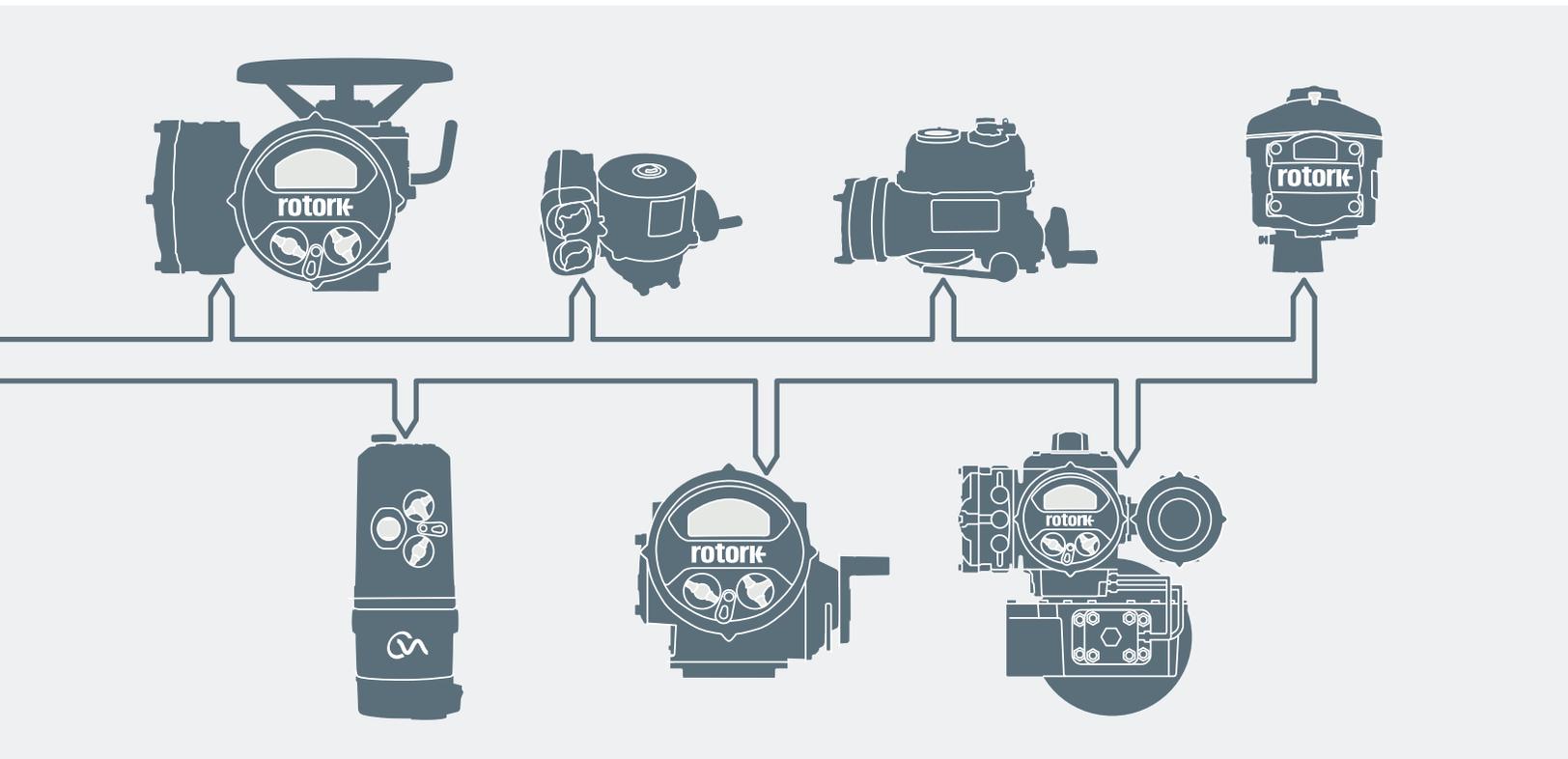
Profibus Features

Control and Feedback

The Profibus module cyclic data collected from the actuator gives information about the status of the valve and actuator combination. In addition, full digital and analogue control of the actuator is available without the need to add more components.

The actual data exchanged during cyclic messages (MS0 messaging) is selected during configuration by choosing the modules to be exchanged.

	Control Data	IQ/IQT	Q	CVA	CMA	ROMpak	SI/EH
Digital Outputs:							
Actuator Control	**Stop**	✔	✔	✔	✔	✔	✔
	Close	✔	✔	✔	✔	✔	✔
	Open	✔	✔	✔	✔	✔	✔
	ESD	✔	✔	✔	✔	✔	✔
	Positioner Enable	✔	✔	✔	✔	✔	✔
	Partial Stroke	✔	✔	✗	✗	✔	✔
Output Status	**Relay 1**	✔*	✗	✗	✔	✗	✗
	Relay 2	✔*	✗	✗	✔	✗	✗
	Relay 3	✔*	✗	✗	✗	✗	✗
	Relay 4	✔*	✗	✗	✗	✗	✗
Analogue Outputs:							
	Desired position	✔	✔	✔	✔	✔	✔

* Extra relay board must be fitted.

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Profibus Features

	Feedback Data	IQ/IQT	Q	CVA	CMA	ROMpak	SI/EH
Digital Inputs:							
IDATA1	**Actuator moving**	✔	✔	✔	✔	✔	✔
	Close limit switch	✔	✔	✔	✔	✔	✔
	Open limit switch	✔	✔	✔	✔	✔	✔
	Actuator running closed	✔	✔	✔	✔	✔	✔
	Actuator running open	✔	✔	✔	✔	✔	✔
	Remote control selected	✔	✔	✔	✔	✔	✔
	Local stop selected	✔	✔	*1	✔	✔	✔
	Local control selected	✔	✔	✔	✔	✗	✔
IDATA2	**Thermostat tripped**	✔	✔	✔	✔	✔	*2
	Monitor relay	✔	✔	✔	✔	✔	✔
	Valve obstructed	✔	✔	✔	✔	✔	✔
	Manual movement	✔	✔	✗	✔	✔	✔
	Moving inhibited	✔	✔	✗	✔	✔	✔
	Positioner moving actuator	✔	✔	✔	✔	✔	✔
	Watchdog recovery	✔	✔	✔	✔	✔	✔
IDATA3	**Battery low**	✔	✗	✗	✗	✗	✗
	Open interlock input	✔	✗	✗	✗	✗	✗
	Close interlock input	✔	✗	✗	✗	✗	*3
	Aux input 1	✔	✗	✗	✗	✗	✔
	Aux input 2	✔	✗	✗	✗	✗	✔
	Aux input 3	✔	✗	✗	✗	✗	✔
	Aux input 4	✔	✗	✗	✗	✗	✔
	Slow mode	*4	✗	✗	✗	✗	✗
IDATA4	**GSD config. permitted**	✔	✔	✔	✔	✔	✔
	Control contention	✔	✔	✔	✔	✔	✔
	Partial stroke in progress	✔	✔	✗	✗	✗	✔
	Partial stroke error	✔	✔	✗	✗	✗	✔
	Primary (0) or Backup (1)	✔	✔	✔	✔	✔	✔
	1 or 2 channels available	✔	✔	✔	✔	✔	✔
	SR (0) or FR (1) nodes	✔	✔	✔	✔	✔	✔
Analogue Inputs:							
	Measured actuator position	✔	✔	✔	✔	✔	✔
	User analogue input channel	*5	✔	✗	✗	✗	✔
	Current actuator torque	✔	✗	✔	✔	✗	✗

1	Test Mode / manual control using Enlight software
2	Fault Relay
3	H/W Partial Stroke input
4	IQT only
5	May require additional analogue input card - check specific actuator literature
Note:	The Aux input 1-4 and Relay 1-4 outputs may be used for direct actuator remote control and indication.

Profibus Features

Parameterisation

When a Profibus slave connects to a host the GSD file values are used to set various parameters in the slave. For the Rotork Profibus module these parameters include the basic actuator performance settings for network control as listed in the table opposite.

These parameters may also be set by a master using EDD or DTM files and in these cases there are many more settings available, including the ability to inhibit the GSD file values from altering the settings made by the PDM or FDT utility. Full details of the capabilities of these files are shown in the instruction manuals for the network cards.

Description
Limited Range Position Min & Max
Deadband and Hysteresis
Motion Inhibit Time
Manual Movement Travel
Valve Jammed Time
Watchdog Timeout & Communications Fault Timer
Action on Loss of Communications
Loss of signal position
Aux Input Mask & ESD DI-4/Net Disable
Redundancy FR/SR mode
Actuator type

Note: Example List. See technical manual for more detail.

Configuration

The configuration of the Profibus module may be selected during the start-up routine for the module when it connects to the highway. Profibus allows for a configuration telegram to be sent to the device to select the arrangement of the data that will subsequently be exchanged during the normal cyclic communication.

The Rotork Profibus module has 10 possible configurations that allow different amounts of data to be exchanged. The choices permit the user to optimise the communication so that data not required by the PLC is not collected. The default setting is 'Configuration 1' which collects the most data.

Config	1	2	3	4	5	6	7	8	9	10
ACTCON	✓	✓	✓	✓	✓	✓	✓	✓	✓	
POS_DV	✓		✓		✓			✓		
O_STAT	✓					✓	✓	✓	✓	
PORTCM										✓
IDATA1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
IDATA2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
IDATA3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
IDATA4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TORQUE	✓		✓		✓	✓		✓		✓
POSITION	✓		✓		✓	✓		✓		✓
ANALOG	✓			✓	✓		✓			✓
PORTST										✓

File Data using FDT Technology

The IQ range of actuators incorporates a sophisticated datalogger, which can provide comprehensive data capture and analysis for planned maintenance and troubleshooting issues with valves and processes. Using FDT and DTM technology it is possible to extract the Datalogger and the configuration file from the IQ range of actuators. These files can then be reviewed and analysed using Rotork Insight software.

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# Profibus Features

Valve torque profile data

Profibus DP-V1 messaging allows for the transfer of background data between the actuator and the host PLC or a PC on the network. V1 messages are in addition to the V0 cyclic messages used for control and monitoring.

Starts - Open	7346
Starts - Close	7782

The Profibus module records the torque profile of the IQ range and CVA range actuators in both the opening and closing directions in 22 registers that can be examined by a host system with V1 capability. In addition a further 4 registers give the number of motor starts in each direction and further registers give information on the actuator torque settings. An OPC server or similarly equipped PLC, PDM or FDT can be used to view this data.
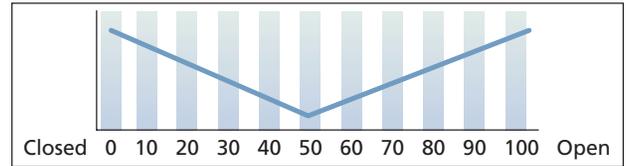

Opening Direction Torque
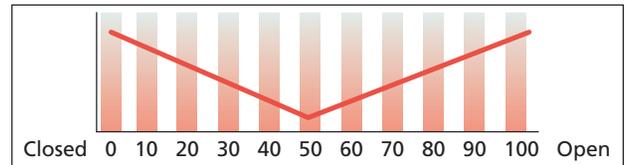
Closing Direction Torque

Profibus Termination

The Profibus highway requires termination at both ends of the network to avoid signal reflections. This termination is active and therefore requires power, which is usually easy at the start of the network, where the PLC / DCS or dedicated termination device in the control room will provide the termination. At the other end of the highway either a dedicated powered device can be used or Rotork provide the facility to terminate at the actuator. The actuator technical manual will indicate how the termination can be achieved, for example on the IQ3, termination can be switched on using the in-built menu. As the termination is powered, it will be removed when the power to the actuator doing the terminating is switched off. This may cause network disruption, therefore care should be taken to accommodate this – usually by switching on the termination in the unit before.
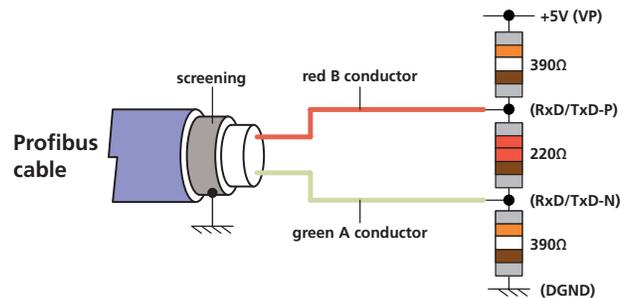
Lightning Protection

The Profibus RS-485 communication ports are fitted with gas discharge tubes to reduce the effect of high voltage transients on the network cables. One discharge tube is provided per port. The protection can be enhanced by the addition of external lightning arrestors. The inclusion of extra components may reduce the operating speed for the network.

A varistor is included on the screen connection, which is isolated from earth, as a discharge path for high voltages induced on the cable screen.
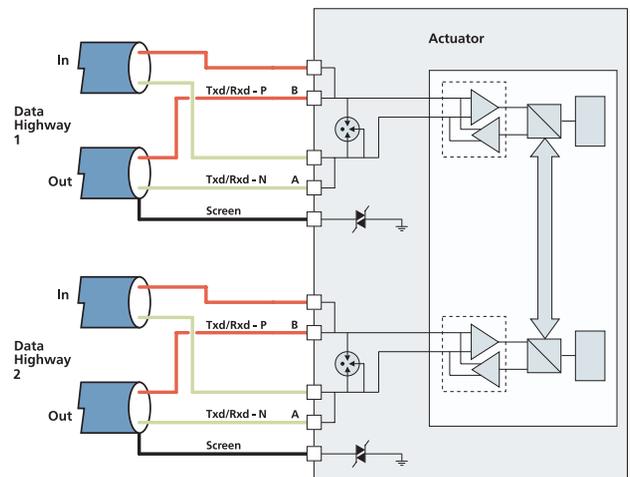
Optional Highway Disconnect Module

IQ and IQT Profibus Highway Disconnect Module

The design criteria of simple highway connection, maintaining a zero stub length and having "bumpless" actuator isolation, have all been encapsulated. The module itself resides within the terminal cover and, when fitted, forms an integral part of the actuator assembly.

Key Benefits

- Highway isolation of actuator
- Bumpless connect / disconnect
- Simple highway connection
- Stranded / solid core cable connectivity
- Zero internal stub length
- IP68 Integrity
- Single / Dual channel option
- Wall mountable docking station available

Note: Special care must be taken when removing the disconnect module in a hazardous area. Please refer to PUB088-005 Profibus Technical Manual.

Simple Highway Connection

The PCB has been specifically designed to accommodate both solid and stranded core cables and helps to reduce the occurrence of field wiring faults. The careful positioning of the screw terminals guarantees correct bend radii of the incoming and outgoing cables, removing the potential of a broken core on solid core cables. The use of screw terminals removes the need for crimps, eliminating another potential error source. The clear and concise PCB labelling ensures simple, error free connection of the Profibus highway to the module.


"Bumpless" Actuator Isolation

Removal of the mains power to the actuator will cause the highway connection to the Profibus PCB to become isolated whilst maintaining the overall Profibus highway continuity. This "bumpless" isolation mechanism allows the actuator to be physically connected and disconnected from the bus without the risk of highway disruption to the remaining Profibus devices.

Zero Internal Stub

The termination module continues Rotork's philosophy of zero internal stubs, essential for high baud rate Profibus highways, by having separate "IN" and "OUT" cabling from the field, via the module, all the way to the Profibus card within the actuator.
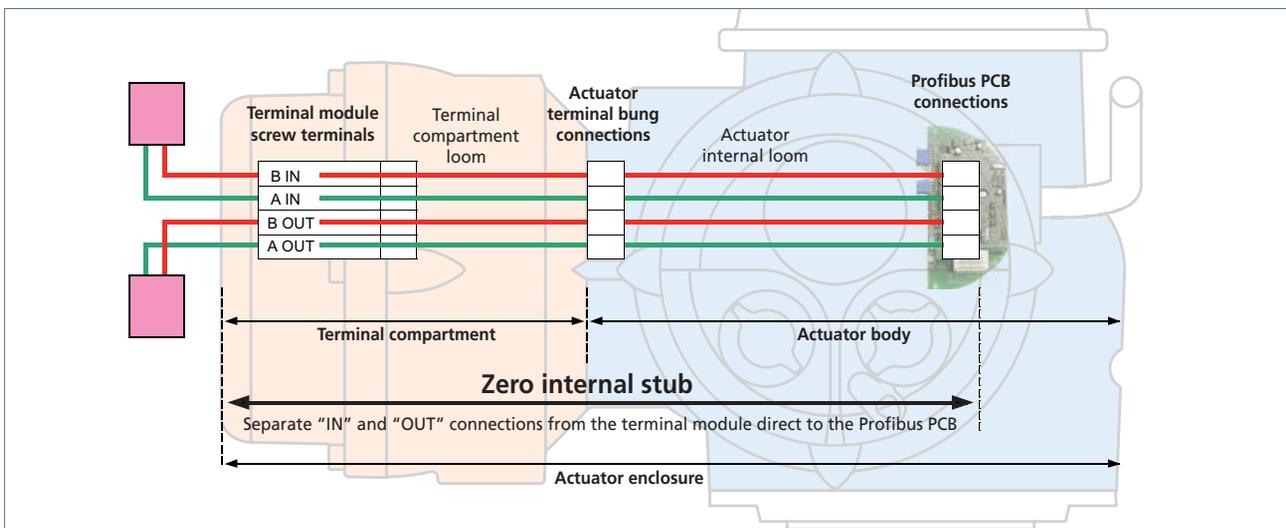
Actuator mains power applied:

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Optional Highway Disconnect Module

IP68 Rated

The new terminal cover does not compromise the superior IP68 rating that makes Rotork the 'fit and forget' choice for all actuator applications.

Four Conduit Entries

The terminal cover also includes up to four additional M25 conduit entries to accommodate separate "IN" and "OUT" cabling for both single and dual channel installations.
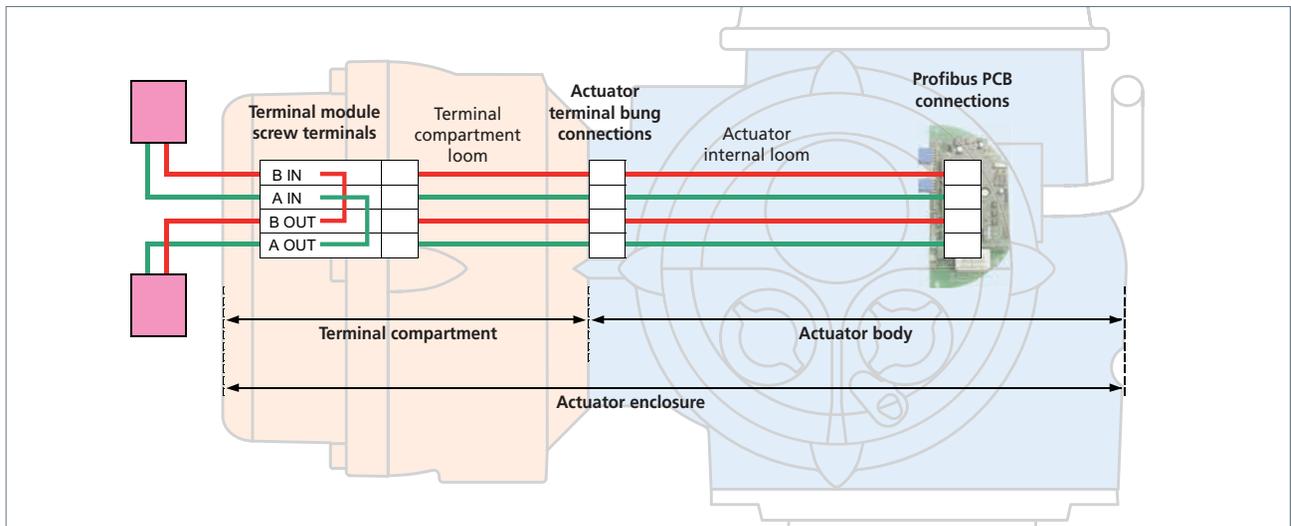
Cost Effective

Incorporating the Profibus Highway Disconnect Module removes the need for costly additional equipment such as highway isolators or junction boxes. It also reduces the quantity of cable terminations, ensuring a more cost effective solution for site installation.
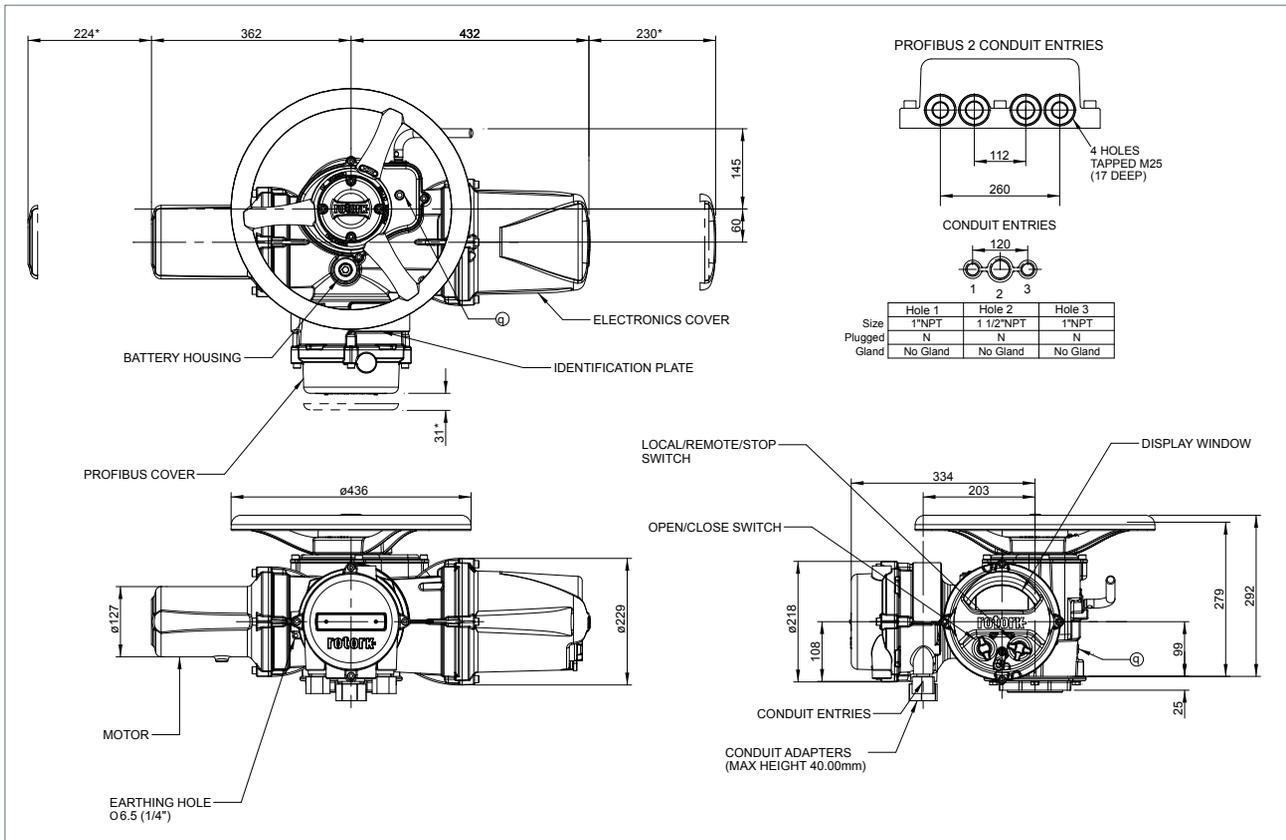
Disconnect Module Cover

In very rare cases where the IQ needs to be removed from the field, a separate module cover can be used to provide environmental protection for the PCB and its associated highway connections. This is a wall mounted docking station that maintains the enclosure rating of the Highway Disconnect Module.

Actuator mains power removed:
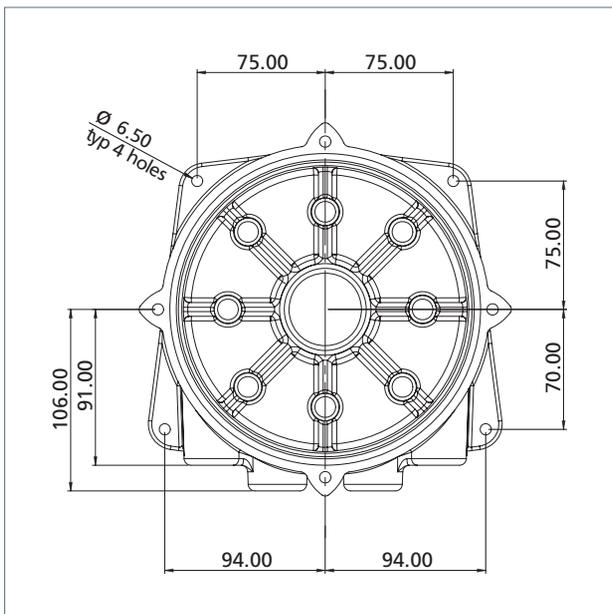
Optional Highway Termination Module

Dimensional Data

PROFIBUS 2 CONDUIT ENTRIES

112
260
4 HOLES
TAPPED M25
(17 DEEP)

CONDUIT ENTRIES

120

1 2 3

	Hole 1	Hole 2	Hole 3
Size	1"NPT	1 1/2"NPT	1"NPT
Plugged	N	N	N
Gland	No Gland	No Gland	No Gland

224* 362 **432** 230*

145
60

ELECTRONICS COVER

BATTERY HOUSING

IDENTIFICATION PLATE

31*

PROFIBUS COVER

ø436

ø127 ø229

MOTOR

EARTHING HOLE
O 6.5 (1/4")

LOCAL/REMOTE/STOP
SWITCH

OPEN/CLOSE SWITCH

CONDUIT ENTRIES

CONDUIT ADAPTERS
(MAX HEIGHT 40.00mm)

DISPLAY WINDOW

334
203

279 292

ø218
108 99
25

IQ3 with optional highway termination module fitted

Dimensions in millimetres

Mounting Dimensions

75.00 75.00

Ø 6.50
typ 4 holes

106.00 91.00

75.00
70.00

94.00 94.00

Termination Module Cover

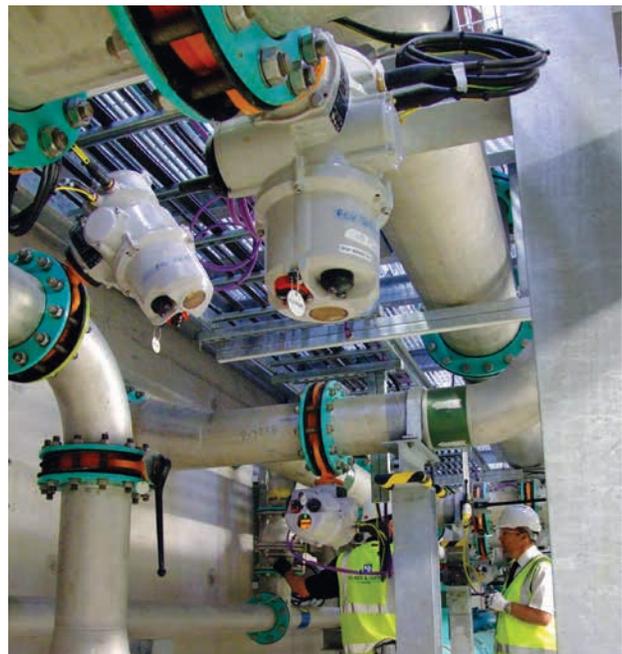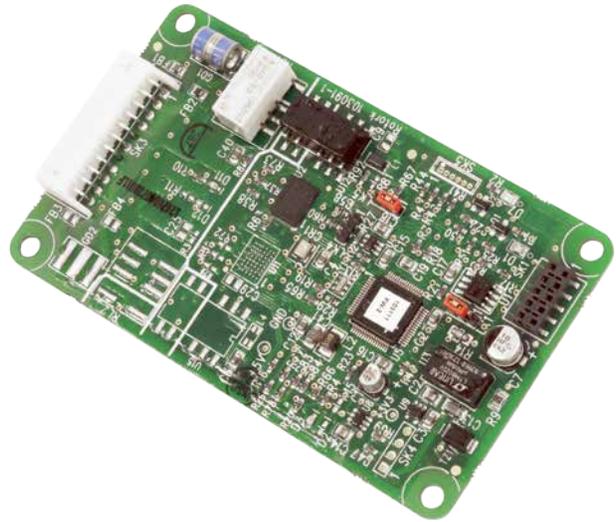**rotork**
Controls

Profibus Technical Data

Interface:	EIA-485 (RS-485) suitable for 2-wire connection.
Number of Channels:	1 on Single channel, fully isolated from actuator circuits 2 on Simple and RedCom Dual channel, fully mutually isolated.
Address Range:	0 to 126, default address 126.
Data Rate:	9,600 baud to 1.5 Mbaud.
Communication Protocol:	Profibus DP, compliant with IEC61158 and EN50170.
Data Communication:	Cyclic DP-V0, Acyclic DP-V1 and RedCom protocol extensions.
Certification:	PNO certified for Profibus standard compliance.
Device Description Files:	EDD (for PDM), certified DTM (for FDT) and GSD files plus bitmap icon file.
Analogue Input:	Check wiring diagram for availability, may require additional Analogue input card.
	4-20 mA or 0-5 VDC, externally powered, 0.1% resolution and 1% linearity at 20 °C, fully isolated.
User Defined Digital Inputs:	4 off (IQ, IQT, SI/EH only), potential-free input contacts.
User Defined Digital Outputs:	4 off contacts 120 VAC @ 5 A or 30 VDC @ 1 A (IQ and IQT only, requires additional relay board option).
Enclosure:	Suitable for fitting within Rotork IQ, IQT, Q, SI/EH, ROMpak and CVA range actuators.
Environment:	-40 to +70 °C, environmentally protected by Rotork actuator double-sealing to IP68 (IQ, IQT, SI/EH, Q and CVA ranges).
Power Consumption:	All Profibus module power is taken from the actuator, no external supply is required.

Rotork Profibus supporting documentation and software are available for download at www.rotork.com

PUB088-005	Profibus DP Module Mk2 Technical Manual
PUB088-002	Device Type Manager (DTM) Solutions

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Redefining Flow Control

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A full listing of our worldwide sales and
service network is available on our website

Scan with your smart phone
for more information on
rotork products and services