Product Documentation

VM10 Fieldbus

SAFETY, WARNING

These products are intended for use in industrial compressed air systems only. Do not use these products where pressures and temperatures can exceed those listed under "Technical Data".

Before using these products with mediums other than those specified, for non-industrial applications, life-support systems, or other applications not within published specifications, consult NORGREN. Through misuse, age, or malfunction, components used in fluid power systems can fail in various modes. The system designer is warned to consider the failure modes of all component parts used in fluid power systems and to provide adequate safeguards to prevent personal injury or damage to equipment in the event of such failure.

System designers must provide a warning to end users in the system instructional manual if protection against a failure mode cannot be adequately provided. System designers and end users are cautioned to review specific warnings found in instruction sheets packed and shipped with these products.

Specific warnings:

» Check if classification of the valve island and marking on the item of equipment are able for case of operation.

» Check technical data, such as operating pressure, voltage level, current type and temperature, on the product label or in the data sheets for compliance with the existing operating conditions.

» After removing the packaging, make sure that no contamination enters into the system.

» Check before the installation of the system that no contamination exists in the piping and valve island.

» Check during installation of the system that gaskets will not become damaged.

» Please consider the information of this operating manual as well as the use conditions and permissible data, which are on the product labels.

» Adapt to the general rules of technology when selecting and using an item of equipment.

» Take measures to avoid unintentional or improper activation.

» Prior to the first electrical operation, ensure no danger would result from the medium exhausting from any open ports.

» Consider in case of pressurised systems that lines, valves and other components should not be removed.

» ATTENTION: There is some risk of injury! The surface of pilot valves could become very warm in continuous operation.

» ATTENTION: Valves with N/O function (normally open) are open without pilot pressure. During commissioning, protection against exhausted medium has to be provided.

» Never use the valve island as lever arm or a step for climbing.

» Protect the valve island from falling objects.

» ATTENTION: Brownout or over-voltage conditions can cause microprocessor-based equipment to malfunction, or, in extreme cases, cause permanent damage.

To guarantee system operation please ensure that:

a. Power supply disturbances are minimised.

b. The operating power supply has a fast power up/down response time.

c. Where possible avoid powering from vehicle battery supplies.

Please contact Norgren technical department for any assistance you may require with reference to products designed for specific harsh environments or non-industrial applications and particularly applications on board vehicle or using batteries as a power supply.

Contents

1. System overview

VM10 is a modular pneumatic valve island incorporating 10.5 mm wide valves with Integrated multipole or Fieldbus interface.

The system comprises a bank of pneumatic valves which are fitted with endplates to provide pneumatic connections to line and exhaust.

A top enclosure provides connections to multipole or Fieldbus versions together with LED indication of valve operation and position. Manual overrides are also provided on the top cover as are label points.

Each valve has push-in-fitting connectors integrated into the lower face with connections to ports 2 and 4 (or 2 x 2 for double 3/2 valves).

DIN rail mounting clips can be fitted to the rear face of the valve island to allow mounting with free access to pneumatic ports. Panel mounting is also possible using the M4 inserts provided in the base.

The valve islands can be configured to incorporate any combination of 5/2 sol/sol, 5/2 sol/spring , 2 x 3/2 NC and NO or 5/3 COP , COE or APB valves.

Multi-pressure operation is also possible.

Versions available are:

Multipole 25 way connector	4 , 6 , 8 , 10 & 12 stations.
Multipole 44 way connector	10 , 12 & 16 stations.
Fieldbus	8 , 10 , 12 & 16 stations.
AS-interface	4, 6, & 8 stations.
Norgren Bus	4, 6, 8, 10,12 & 16 stations

The VM10 valve islands when fully assembled have an IP65 protection rating.

Specifications

All Norgren electronic products are tested to vibration standard BSEN 60068-2-6

All electronic components are compliant with the EMC Directive 89/336/EEC, test references EN550081-2 and EN550082-2

2. Compliance

All Profibus-DP components are compliant with the Profibus-DP specification DIN 19245 parts 1 and 3.

All Interbus-S components are compliant with the Interbus-S specification DIN 19258.

All DeviceNet components are compliant with the DeviceNet specification Vol. 2.0 A-15

All CANopen components are compliant with the CANopen communication profile CiA DS-301 V4.01.

All AS-interface components are compliant with the AS-interface specification IEC 62026/6 and EN 50295

All electronic components are compliant with the EMC Directive 89/336/EEC test references EN550081-2 and EN550082-2.

3. Power and EMC precautions

All Norgren VM10 products are designed to be used with a Safety Extra Low Voltage Supply so that a protective earth is not required. A Safety Extra Low Voltage supply is designed so that the primary and secondary supplies are isolated by typically 3KV. This means that an earth connection for safety reasons is not required because the supply voltage is restricted to a maximum of 42.2 volts even under fault conditions.

The Earth, however, must be connected. It is not a protective earth, but is required to provide EMC shielding.

Electrostatic precautions must be taken whilst handling component parts of the valve island. This means that whilst assembling or reconfiguring a valve island the assembler must be connected to earth by means of a special electrostatic earth strap.

Once the valve island is fully assembled it is protected from electrostatic discharge.

Power must be removed from the system while assembling and dis-assembling the component parts or connecting Fieldbus or power cables.

4. Multipole operation

Multipole versions of VM10 are intended for direct connection to a control system output device.

The VM10 multipole valve island is provided with a "D" connector with individual pins for solenoid operation and supply common.

Common positive and negative versions are available.

Outputs are polarity protected and incorporate LED indicators and diode noise suppression.
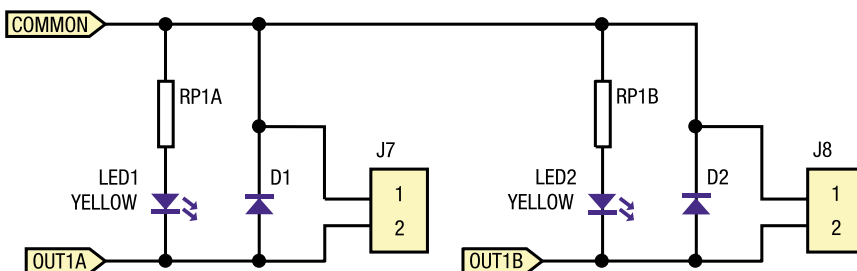
Station number	Valve/Sol	Signal Pins 25	44	12 Valve/Sol	Signal Pins 25	44
1	14	1	1	12	14	16
2	14	2	2	12	15	17
3	14	3	3	12	16	18
4	14	4	4	12	17	19
5	14	5	5	12	18	20
6	14	6	6	12	19	21
7	14	7	7	12	20	22
8	14	8	8	12	21	23
9	14	9	9	12	22	24
10	14	10	10	12	23	25
11	14	11	11	12	24	26
12	14	12	12	12	25	27
13	14	N/C	13	12	N/C	28
14	14	N/C	14	12	N/C	29
15	14	N/C	15	12	N/C	30
16	14	N/C	31	12	N/C	32
				Common	13	44

Looking into node connector
25 Pin connector - Male
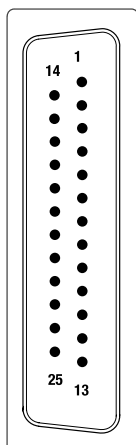
Looking into node connector
44 Pin connector - Male
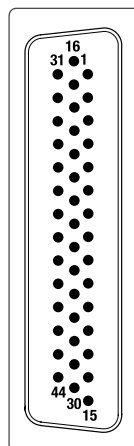
5. Valve power connection

An M12 four pin connector provides the user with an IP65 rated connection point for both the valve and logic circuit power supply.
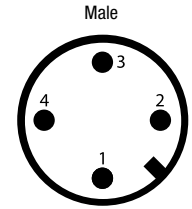
Pin No:	Function	Tolerance	Maximum Current
1	24 VB Logic Circuit Supply	+/-30%	300mA
2	24 VA Valves	+/-10%	1.5A
3	0 Volts	-	1.53A
4	Earth	-	-

Male

Looking into node connector

Two 24 Volt power input lines allow power to the solenoids within the valve island to be isolated in case of emergency, whilst still leaving the logic circuits of the valve island active thus still maintaining communication with the host controller.

Both DeviceNet and CANopen VM10 Nodes do not use pin 1 of the M12 power connector this is due to the power for the logic circuit being drawn from the network connection.

6. Basic Fieldbus operation

The following Fieldbus versions of VM10 are available.

Profibus-DP

DeviceNet

Interbus-S

AS-interface

CANopen

AB RIO

Norgren FBII serial wireway

The VM10 top enclosure incorporates the Fieldbus interface together with appropriate connectors and indicator LEDs. Each solenoid has its own associated yellow LED within the Valve Island.

Each valve is mapped onto the controller outputs directly or by the use of electronic data files supplied with the VM10 valve island.

7. Profibus-DP specification

Norgren Profibus-DP Fieldbus systems conform to DIN 19245 Part 3.

Communication System: 2 wire RS485 hardware communication protocol Transmission Speed: 9.6 Kbits/s to 12 Mbits/s. Automatic detection.

Maximum Nodes Per Network: 126

Total Number Of I/O Per Network: 32256

Bus Topology: Line

Wiring specification

The bus line is specified in EN 50170 as line type A. It can be used as shown in the following table. The table gives the bus parameters and line lengths of A and B for comparison, however it is recommended that only type A lines are used due to their expanded length.

Line parameters:

Parameter	Line A	Line B (avoid if possible)
Impedance In Ohms	135 to 165	100 to 130
Capacitance per unit length (pF/m)	< 30	< 60
Loop resistance (ohms/km)	110	---
Core Diameter (mm)	0.64	>0.53
Core cross section (mm2)	>0.34	>0.22

Line Lengths:

Transmission Rate (kbit/sec)	9.6	19.2	93.75	187.5	500	1500	12000
Line A	1200	1200	1200	1000	400	200	100
Line B	1200	1200	1200	600	200	-	-

Calculating Possible Line Lengths:

The maximum admissible distance between two bus stations in each PROFIBUS network can be calculated as follows:
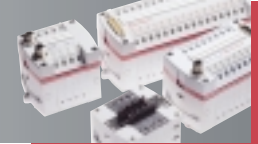
(NO_REP + 1) * Segment length

NO_REP= The maximum number of repeaters connected in series (depends on repeater type).

Example: The repeater manufacturer's specifications allow nine repeaters to be connected in series.

The maximum distance between two bus stations at a data transfer rate of 1500 kbit/s is then as follows:

(9 + 1) * 200 m = 2000 m

Cable Suppliers:

Name	Supplier	Part number
Unitonic-Bus L2	Lapp	2170221T
Unitonic-Bus	Lapp	217022T
L2 Bus Cable	Siemens	6XV1830-OAH10

Wiring termination

The active bus termination using a resistor combination avoids signal reflections during data transfer and ensures a defined zero-signal voltage on the data lines when none of the stations on the bus are active. Active termination must be provided at the beginning and end of each RS485 bus segment.

If the bus termination is missing, this can cause errors during data transfer. Problems can also arise if too many bus terminators are fitted since each bus terminator also represents an electrical load and reduces the signal levels and thus the signal-to-noise ratio. Too many or missing bus terminators can also cause intermittent data transfer errors, particularly if the bus segment is operated close to the specified limits for maximum numbers of stations, maximum bus segment length and maximum data transfer rate.

5 V (1)

390 Ω

Data Line - B(4)

220 Ω

Data Line - A(2)

390 Ω

GND(3)

VP(6)
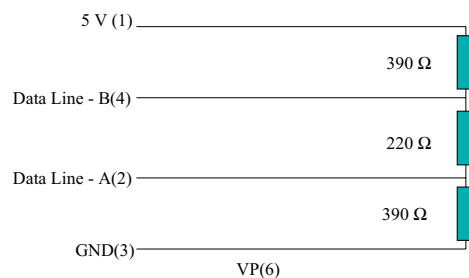
Line termination of wire A in acc. With EN 50 170

The power required by the active bus termination is usually obtained through the bus connector from stations connected to the bus. Alternative measures must be taken if there is no guarantee that the power required by the bus termination is permanently provided while the bus is operating. For example, in a particular installation the station providing the power to the bus termination may need to be repeatedly switched off or removed from the bus for operational reasons. In such cases, the bus termination should use an external power supply or a repeater should be used for bus termination instead.

Connections to the Norgren Profibus Node

M12 connector version

Pin Number	Function
1	5VI Opto Isolated
2	A-Line (Green)
3	0VI Opto Isolated
4	B-Line (Red)
5	Shield
Threaded Joint	Shield

Male

Female

Communication in

Communication out

Looking into connector
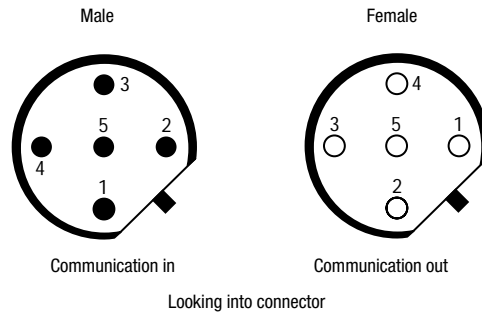
D'type connector version

Pin Number	Function
1	Shield
2	N/C
3	B-line (Red) RxD / TxD-P
4	CNTR-P (RTS)
5	DGND (0VI) opto Isolated
6	VP (5VI) opto Isolated
7	N/C
8	A (Green) RxD / TxD-N
9	CNTR-N (direction control)

Female

Looking into node connector
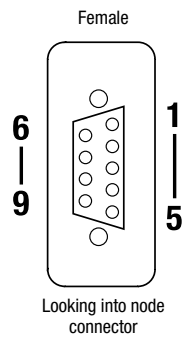
Address and Baud rate setting

The Norgren Profibus-DP VM10 valve island address can be set within the range 1 to 126 using a master controller with the capacity to change slave addresses or with a hand-held or PC based configuration device.

In addition the module also uses rotary coded switches which can be set to give an address range from 1 to 99 when both address switches are set to 0 the module may be addressed via software only. Manufactures default address is 99.

Access to the address switches can be achieved by removing the two securing screws retaining the switch window, it is important to ensure the window is reassembled correctly to ensure the IP65 rating is retained. See drawing below;

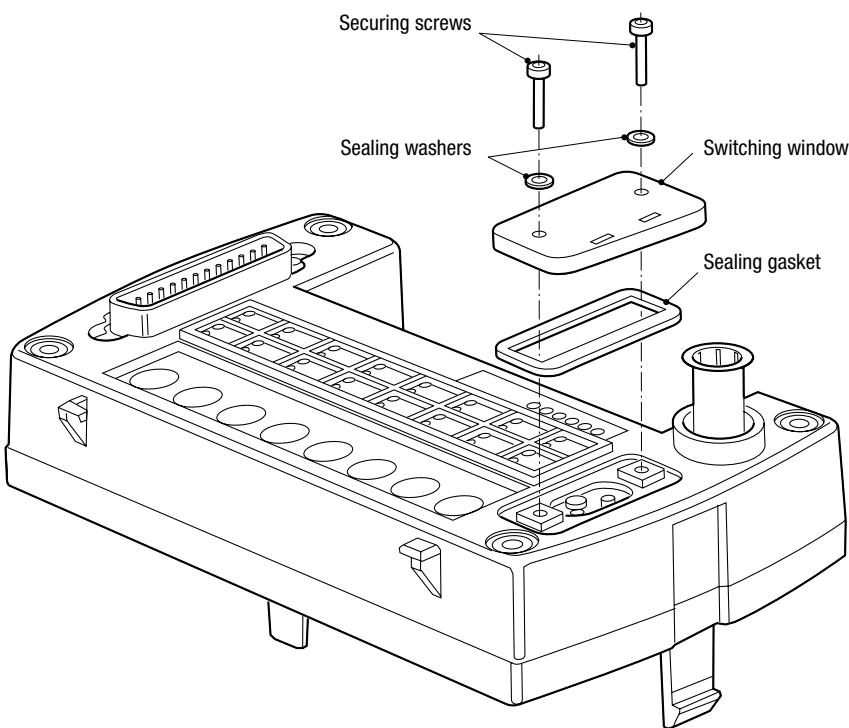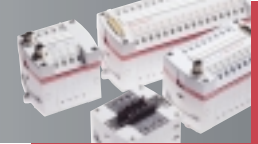The baud rate can be 9.6, 19.2, 45.45, 93.75, 187.5, 500, 1500 or 12,000 kbits/sec and is detected automatically.

Address of each valve output

Bus	Solenoid 1-4	1 Byte				2 Bytes				3 Bytes				4 Bytes			
		0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
Connection	Solenoid 1-2	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31

8 Stations

10 Stations

12 Stations

16 Stations

Default node address – 125

Indicators

24V (Green) – This LED will only be energised when 24 volts is applied to the valve power terminal of the power supply connector.

5V (Green) – This LED will only be energised when a 24 volt supply is applied to the electronic supply terminal of the power supply connector, indicating that the logic circuit of the module is powered.

Status (Green) – This LED indicates the operating status of the device.

Data Exchange (Green) – This LED indicates the status of the network traffic, indicating when network packages are received.

5VI (Green) – This LED indicates the power status of the opto-isolated side of the Profibus phyical layer.

Indicator Status During Powering Up and Commissioning

Condition	24V	5V	Data Exchange	5VI	Status
Power Up	On	On	Off	On	Flickering
Changing of Address During Commissioning	On	On	Off	On	On
Device In a Stopped State	On	On	Off	On	Flickering
Device In an Operation state	On	On	On	On	On

Commissioning

Due to the increasing number of compatible master controllers it would be impractical to create detailed instructions for commissioning the Norgren node on a particular master. All Norgren Profibus products are conformance tested to the latest specification by an independent authorized test site and are fully certified by the Profibus International Group. Because of this we feel that the help guide and manual supplied with the users chosen PLC should be used during the commissioning stages of each Norgren node.

GSD File

A GSD file is used to identify a PROFIBUS-DP/PA device. (Master or Slave). It contains data making it possible to have manufacturer independent configuration tools. Typical information in a GSD file is Vendor information, Baudrates supported, Timing information, Options/features supported and Available i/o signals. A GSD file must be available for every DP/PA slave. This is installed into the PLC configuration software loaded into the products catalogue, in the additional field devices section.

Other Related Documents

Profibus Group: Profibus-DP/FMS Installation Guideline Order Number 2.112

Related Web Sites

www.profibus.com   Profibus Worldwide Organisation

www.profibus.co.uk   Profibus Europe Organisation

www.ad.siemens.de   Siemens Automation and Drive
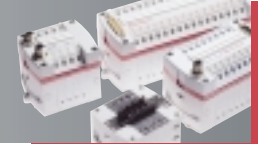
8. DeviceNet Specification

Norgren DeviceNet systems conform to DeviceNet Volume 1 Release 2 and the Pneumatic Valve Device Profile.

Communication System: 2 wire CAN hardware communication protocol

Number Of Nodes Per Network: 64

Bus Topology: Line with drops.

Line Parameters

Wiring specification

Parameter	Thick Cable	Thin Cable
Impedance In Ohms	120 +/- 10%	120 +/- 10%
Capacitance per unit length (pF/f)	12	12
Jacket Marking	Vendor Name & Part #.	Vendor Name & Part #.
Core Diameter (mm)	#18 Copper 19 Strands	#24 Copper 19 Strands
Outside Diameter	0.410 - 0.490 inches round	0.240 - 0.280 inches round

Suppliers:

Belden Trunk Cable	Type 3082A, 3083A	Supplier	Belden
Belden Drop Cable	Type 3084A, 3085A	Supplier	Belden
Trunk & Accessories		Supplier	Molex
Trunk & Accessories		Supplier	Brad Harrison

Line Lengths:

Baud Rate (in kB)	Trunk Cable Length (max.)
125	500m
250	250m
500	100m

Wiring termination
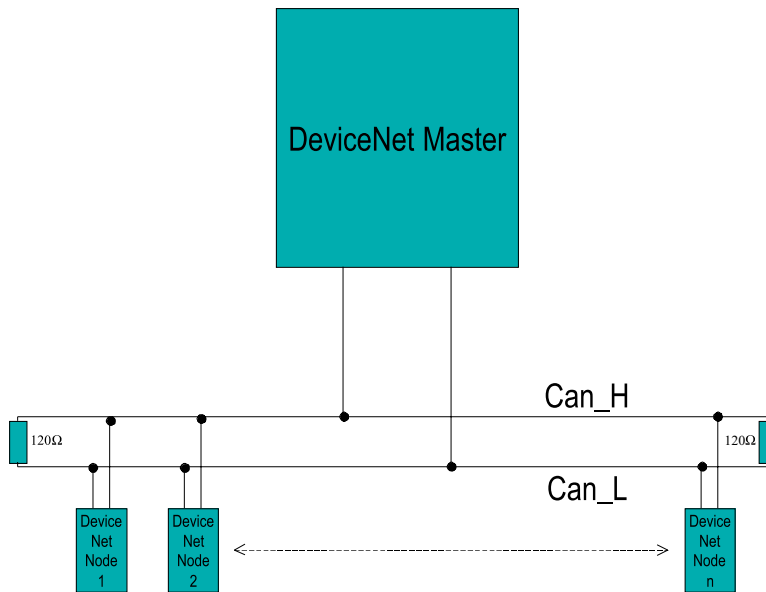
DeviceNet Master

Can_H

Can_L

120Ω   120Ω

Device Net Node 1   Device Net Node 2   Device Net Node n

Cable termination is required at both extreme ends of the trunk cable. This can be done simply with a 120Ω resistor between the communication lines or by using purpose designed terminators that fit onto the tee-adapter

Connector details

M12 connector

Pin Number	Function
1	Drain
2	V+
3	V-
4	CAN_H
5	CAN_L

Male

Looking into connector
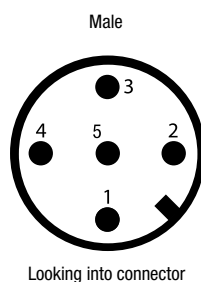
Address and baud rate setting

The Norgren VM10 DeviceNet valve island address can be set within the range 0 to 63 using configuration software such as Rockwell RSNetworx and suitable hardware for connection to the DeviceNet bus or by the use of a separate master simulator with the capacity to change address.

In addition the module also uses rotary coded switches which can be set to give an address range from 0 to 63 when the address switches are set to an address over 63 the module may be addressed via software only. Manufactures default address is 63.

Access to the address switches can be achieved by removing the two securing screws retaining the switch window, it is important to ensure the window is reassembled correctly to ensure the IP65 rating is retained. See drawing below;
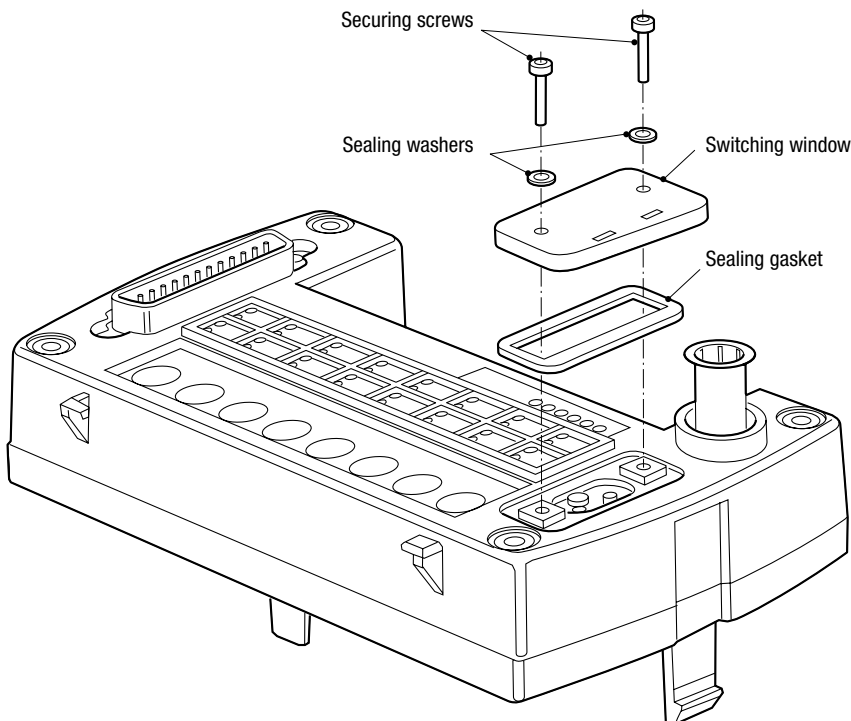
125 , 250 & 500 Kb/sec baud rates are supported by the VM10 DeviceNet valve island and are detected automatically.

Address of each valve output

Bus	Solenoid 1-4	1 Byte				2 Bytes				3 Bytes				4 Bytes			
		0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
Connection	Solenoid 1-2	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31

◄— 8 Stations —►

◄— 10 Stations —►

◄— 12 Stations —►

◄— 16 Stations —►
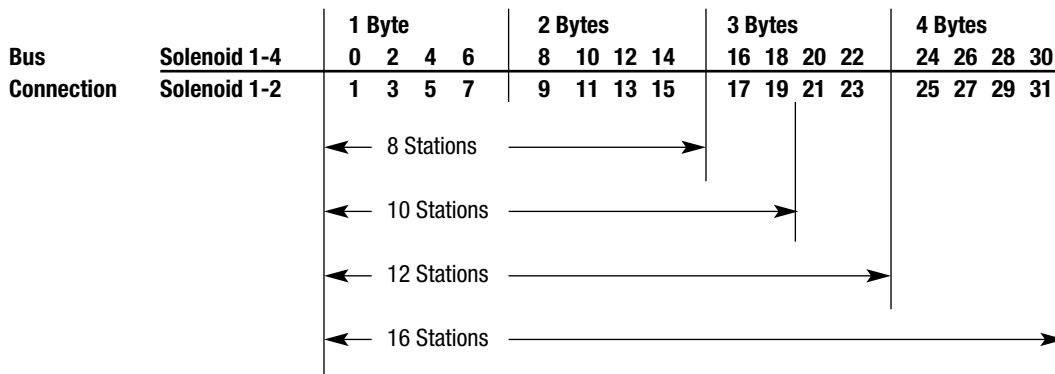
Default node address – 63

Indicators

24V (Green) – This LED will only be energised when 24 volts is applied to the valve power terminal of the power supply connector.

5V (Green) – This LED will only be energised when the Network power is connected to the Network connector, indicating that the logic circuit of the module is powered.

Module Status (Red/Green) – This LED indicates the device and whether it is operational or working correctly

Network Status (Red/Green) – This LED indicates the status of the CAN communication link.

Indicator Status During Powering Up and Commissioning

Condition	24V	5V	Module Status	Network Status
Power Up	On	On	Single Flash	Single Flash Green/Red
Auto Baud Rate Detection Active	On	On	Green	Off
Changing of Address During Commissioning	On	On	Green	Green
Device In a Pre-operation State	On	On	Green	Flashing Green
Device In an Operation state	On	On	Green	Green
Connection Time Out	On	On	Green	Flashing Red
Failed Communication	On	On	Green	Red
Un-recoverable Fault	On	On	Red	Dependant

Commissioning

The electronic data sheet (EDS) library is a collection of EDS files that can be registered with RSNetWorx for Allen Bradley PLC's and Compbus/D configurator for Omron PLC's.

The EDS files, which are provided by Norgren and other manufacturers, contain configuration and identification information for the devices. RSNetWorx for DeviceNet software can access only those devices that have been registered. You must use the EDS Wizard within RS Networx for registering EDS files for unknown devices, or if you have updated EDS files to install. To install a new EDS file to your PLC please refer to the PLC manufacturers instruction manual or online help.

Although you receive a large number of electronic data sheet (EDS) files with the configuration software for DeviceNet, there may be a time when you need to acquire other manufactures EDS files from the ODVA www.odva.org (Open DeviceNet Vendor's Association) web site.

DeviceNet node commissioning tool (RS Networx Only)

The DeviceNet node commissioning tool lets you commission, that is, set the node address and the data rate parameters of, devices that are either connected to a DeviceNet network, or via a point-to-point connection.

Commissioning devices on a DeviceNet network

Before you can add any node to a live DeviceNet network, it must be commissioned. This means that a node address and a data rate must be programmed into the device. All Norgren VM10 nodes are preset with a node address, which is usually set to 63, unless other wise stated by the user in the valve island configurator. baud. These default preset values will need to be changed to meet your application needs. Once a device has been commissioned and attached to a network, you can use the RSNetWorx for DeviceNet node commissioning tool to edit the node address that was set previously. Some devices do not permit software setting of the node address or data rate. Refer to the device documentation for specific information.

For example, if two of the devices on your network are a photoelectric sensor and a hand controller and you accidentally change the node address of the hand controller to be the same as that of the photoelectric sensor, then the hand controller will no longer have a unique address, which means that it will not be able to communicate on the network. If you cannot access a device, because you have used its node address for another device, you will have to remove it from the network, recommission it, then reinstall it on the network.

Other Related Documents

Rockwell Automation:	RS Networx; Getting Results

Allen-Bradley:	DeviceNet Cable System Planning and Installation Manual

Allen-Bradley:	SLC 500 Addressing Reference Manual

Related Web Sites

www.odva.org	Open DeviceNet Vendors Association

www.rockwellautomation.com	Rockwell Automation

www.ab.com	Allen-Bradley

9. CANopen Specification

Norgren CANopen systems conform to CANopen communication profile CiA DS-301 V4.0

Communication System: 2 wire CAN hardware communication protocol Number of Nodes per Network: Master + 63 slaves

Bus Topology: Line with drops.

CANopen Wiring Specification

Line Parameters:

Parameter	Thick Cable	Thin Cable
Impedance In Ohms	120 +/- 10%	120 +/- 10%
Capacitance per unit length (pF/f)	12	12
Jacket Marking	Vendor Name & Part #.	Vendor Name & Part #.
Core Diameter (mm)	#18 Copper 19 Strands	#24 Copper 19 Strands
Outside Diameter	0.410 - 0.490 inches round	0.240 - 0.280 inches round

Suppliers

Belden Trunk Cable	Type 3082A, 3083A	Supplier	Belden
Belden Drop Cable	Type 3084A, 3085A	Supplier	Belden
Trunk & Accessories		Supplier	Molex
Trunk & Accessories		Supplier	Brad Harrison

Line Lengths

Baud Rate (in kB)	Trunk Cable Length (max.)
10	5000m
20	2500m
50	1000m
125	500m
250	250m
500	100m
800	50m
1000	25m

CanOPEN Master

Can_H

120Ω

120Ω

Can_L

Can Node 1

Can Node 2

Can Node n
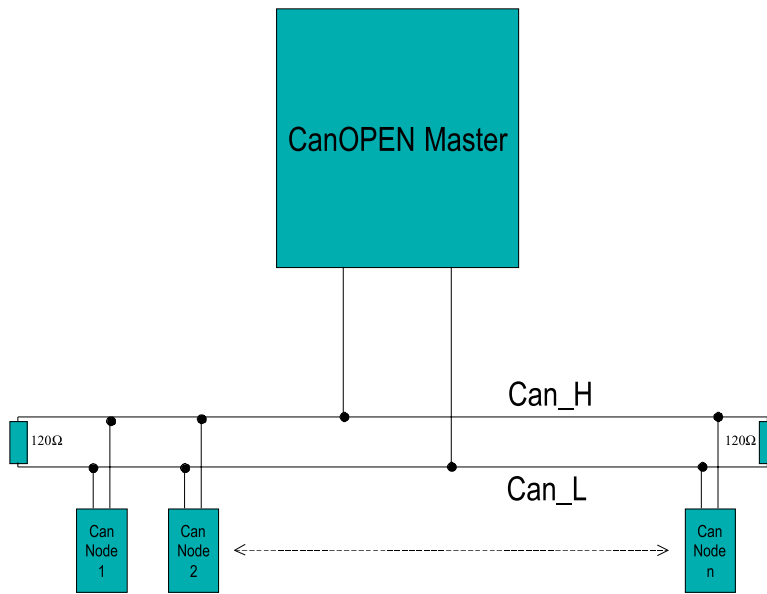
Line Termination In Accordance With ISO 11898

Cable termination is required at both extreme ends of the trunk cable. This can be done simply with a 120Ω resistor between the communication lines or by using purpose designed terminators that fit onto the tee-adapters.

CanOPEN Connections

M12 connector

Pin Number	Function
1	Drain
2	V+
3	V-
4	CAN_H
5	CAN_L

Male
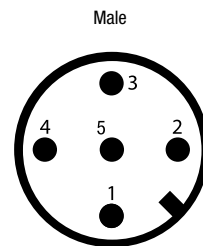
Looking into node connector

Address and baud rate setting

Changing the address of the node:

Using a CANopen configuration tool connected to the network the address of each node maybe changed by the following method:

Send an SDO Telegram command to the node at SDO index 2100h containing the new node address, valid range 1-127. View example of SDO message below

Description	SDO Index	Sub Index	Value
EEPROM Node Address	2100h	0	1-127

The Norgren CANopen node also supports the layer setting service (LSS). The following configuration services are avalible

Service	COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Switch Mode Global	2021h	CS=04	Mode			Reserved			
Configure Node ID	2021h	CS=17	Address			Reserved			
Configure Bit Timing	2021h	CS=19	Table Selector	Table Index			Reserved		
Activate Bit Timing	2021h	CS=21	Switch Delay				Reserved		
Store Configuration	2021h	CS=23			Reserved				

In addition the module also uses rotary coded switches which can be set to give an address range from 1 to 99 when both address switches are set to 0 the module may be addressed via software only. Manufactures default address is 99.

Access to the address switches can be achieved by removing the two securing screws retaining the switch window, it is important to ensure the window is reassembled correctly to ensure the IP65 rating is retained. See drawing below;
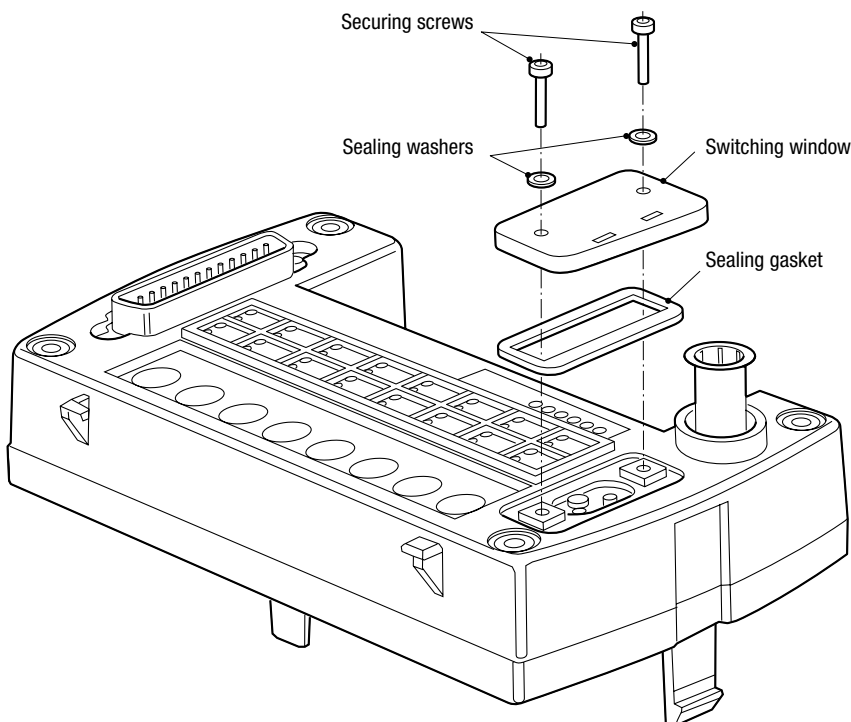
The following baud rates are supported by the VM10 CANopen node 10, 20, 50, 125, 250, 500, 800, 1000 kbits/sec and are detected automatically.

Address of each valve output

		1 Byte				2 Bytes				3 Bytes				4 Bytes			
Bus	Solenoid 1-4	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
Connection	Solenoid 1-2	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31

← 8 Stations →

← 10 Stations →

← 12 Stations →

← 16 Stations →

Default node address – 127

Indicators

24V (Green) – This LED will only be energised when 24 volts is applied to the valve power terminal of the power supply connector.
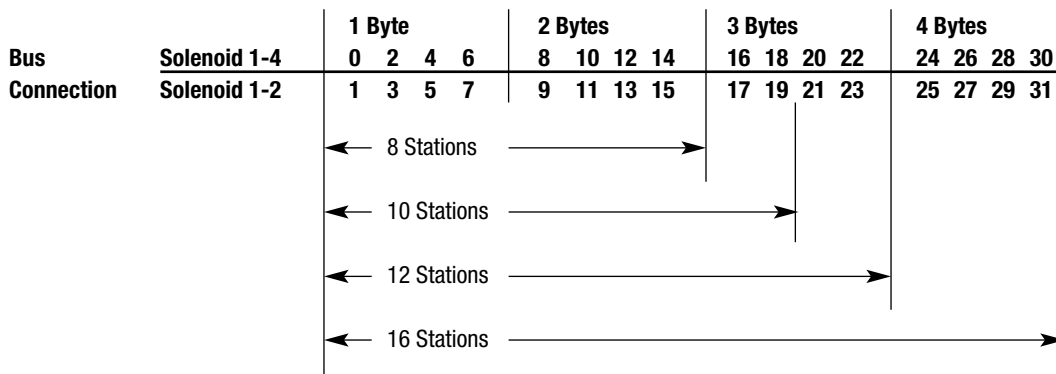
5V (Green) – This LED will only be energised when the Network power is connected to the Network connector, indicating that the logic circuit of the module is powered.

Error LED (Red) – This LED indicates the status of the CAN physical and indicates errors due to missing CAN messages (SYNC,GUARD or HEARTBEAT).

Run LED (Red/Green) – This LED indicates the status of the CANopen network state machine.

Indicator Status During Powering Up and Commissioning

Condition	24V	5V	Error LED	Run LED
Power Up	On	On	Single Flash	Single Flash Green / Red
Auto Baud Rate Detection Active	On	On	Flickering	Flickering Green
Changing of Address During Commissioning	On	On	Flickering	Flickering Green
Device In a Pre-operation State	On	On	Off	Blinking Green
Device In a Stopped State	On	On	Off	Single Flash Green
Device In an Operation state	On	On	Off	On Green

Indicator Status During CAN message Errors

Condition	24V	5V	Error LED	Run LED
Too Many Error Frames Received	On	On	Single Flash	Dependent on Device State
Heatbeat Event Has Occurred	On	On	Double Flash	Dependent on Device State
A Sync Message Has Not Been Received	On	On	Triple Flash	Dependent on Device State
Bus Off	On	On	On	Dependent on Device State

Commissioning

Due to the increasing number of compatible CANopen master controllers it would be impractical to create detailed instructions for commissioning the Norgren node on a particular master. All Norgren CANopen products are conformance tested to the latest specification by an independent authorised test site and are fully certified by the CIA. Because of this, the help guide and manual supplied with the users chosen PLC should be used during the commissioning stages of each Norgren node.

Other Related Documents

CIA: CIA DS 301-V4.01   CANopen Application Layer and Communication Layer

CIA: CIA DR 303-V1.1   CANopen Cabling and Connector Pin Assignment

CIA: CIA DR 305-V1.0   CANopen Layer Setting Services and Protocol (LSS)

Related Web Sites

www.can-cia.org/canopen/   CAN In Automation

10. Interlock version

Some fieldbus versions of VM10 valve islands can be provided with an "Interlock" connector which is used to supply power for each valve coil from an external source.

This can be connected through a series of external switches to ensure that a valve coil can only energise if the interlock path is complete. This can be used to provide interlocking for safety gates etc.

44 WAY POWER CONNECTOR +24V
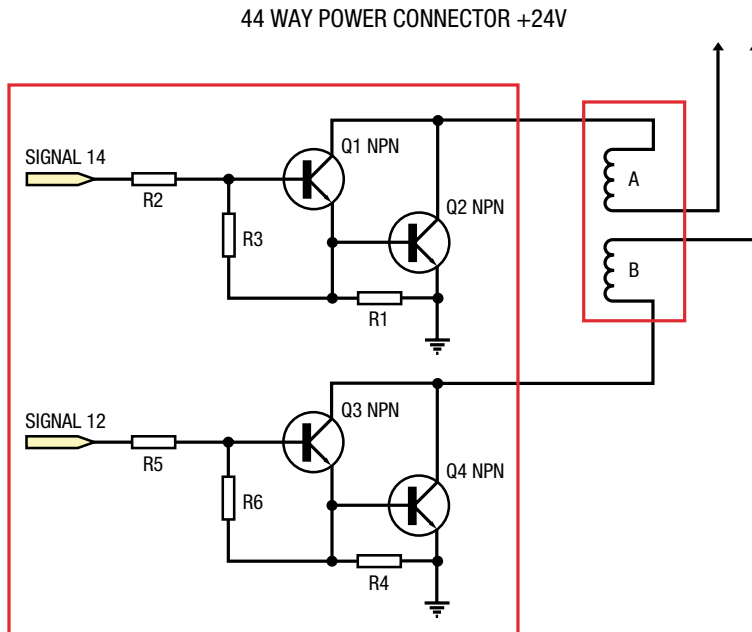
Valve/Sol	8	10	12	16	Valve/Sol	8	10	12	16
14	16	20	24	32	12	15	19	23	31
14	14	18	22	30	12	13	17	21	29
14	12	16	20	28	12	11	15	19	27
14	10	14	18	26	12	9	13	17	25
14	8	12	16	24	12	7	11	15	23
14	6	10	14	22	12	5	9	13	21
14	4	8	12	20	12	3	7	11	19
14	2	6	10	18	12	1	5	9	17
14	N/C	4	8	16	12	N/C	3	7	15
14	N/C	2	6	14	12	N/C	1	5	13
14	N/C	N/C	4	12	12	N/C	N/C	3	11
14	N/C	N/C	2	10	12	N/C	N/C	1	9
14	N/C	N/C	N/C	8	12	N/C	N/C	N/C	7
14	N/C	N/C	N/C	6	12	N/C	N/C	N/C	5
14	N/C	N/C	N/C	4	12	N/C	N/C	N/C	3
14	N/C	N/C	N/C	2	12	N/C	N/C	N/C	1
Common	44	44	44	44	Common	44	44	44	44

N.B. To maintain EMC compatibility it is advisable that a screened cable is used when the cable length is in excess of 1 metre.
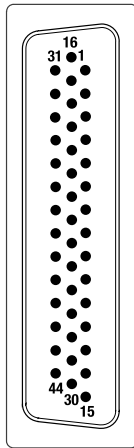
Looking into node connector
44 Pin connector - Male

11. Interbus-S specification

Norgren Interbus-S Fieldbus systems conform to DIN19258

Communication System: 4 wire RS422 hardware communication protocol

Number Of Nodes per Network: Master + 512 Nodes Including Remote Slaves

Total Number Of I/O Per Network: 4096

Bus Topology: Ring

Note: Norgren Interbus-S VM10 valve islands are intended for connection to the Interbus-S Remote Bus system and if connected to Local bus may cause damage to the internal circuitry For Installation Remote Bus applications please contact Norgren Technical.

Wiring specification
Line Parameters:

Parameter	Lutze(manufacturer)
Impedance In Ohms	158
Outer Jacket	PVC
Core Diameter (mm)	3*2*0.25
Outside Diameter (mm)	8.6

Line Lengths:

Transmission Rate In kbit/sec	500
Main Line Between Nodes	400M
Maximum Length	13Km

Connectors

Outgoing Remote Bus D-Sub Connector (Female)		Incoming Remote Bus D-Sub Connector (Male)	
Pin Number	Signal	Pin Number	Signal
1	DO	1	DO
2	DI	2	DI
3	0VI	3	0VI
4	*	4	*
5	+5VI**	5	*
6	/DO	6	/DO
7	/DI	7	/DI
8	*	8	*
9	RBST**	9	-

Male   Female

6 — 9   1 — 5   1 — 5   9 — 6

Communication in   Communication out

Looking into node connector
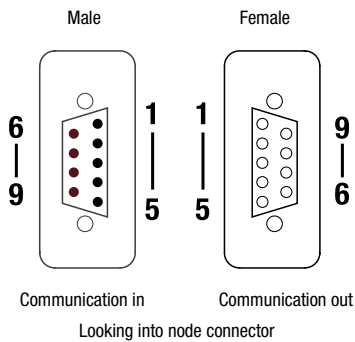
*   Do not connect to pins 4 or 8

**   If used, the outgoing bus connector should have pins 5 and 9 connected together to indicate the presence of a device on the outgoing bus.

Addressing and baud rate

The address of the valve island outputs are determined during configuration. The baud rate is fixed at 500 kbaud.

Address of each valve output

Bus	Solenoid 1-4	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
Connection	Solenoid 1-2	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31

← 8 Stations →

← 10 Stations →

← 12 Stations →

← 16 Stations →

Indicators

24V (Green) – This LED will only be energised when 24 volts is applied to the valve power terminal of the power supply connector.

5V (Green) – This LED will only be energised when a 24 volt supply is applied to the electronic supply terminal of the power connector, indicating that the logic circuit of the module is powered.

UL (Green) – This LED will only be energised when the Network power is connected to the Network connector, indicating that the logic circuit of the module is powered.

RC (Green) – This LED will only be energised when a cable connection is made to the incoming connector of the device.

BA (Green) – This LED will only be energised when communication is established on the network from the master.

RD (Yellow) – This LED will only be energised when no connection is made to the device, or the master is in an offline state.

Indicator Status During Powering Up and Commissioning

Condition	24V	5V	UL	RC	BA	RD
Power Up	On	On	On	Off	Off	On
No Operationing State (Master Offline)	On	On	On	On	Off	On
Establishing Communication With Master	On	On	On	Flickering	On	Off
Device In an Operation state	On	On	On	On	On	Off

I.D and length codes

VM10 Valve island only offer output connections and each size of Interbus node is configured to the fewest possible appropiate number of outputs and stores the corresponding ID code.

Possible VM10 Interbus 'S' I.D. Codes

Number Of Stations	Connection Size	ID Code
8	16	0101h
10	24	010Bh*
12	24	010Bh*
16	32	0102h

* The host controller boards support the data width only as of firmware version 3.2 and PC AT boards of driver version 2.0.

Commissioning

Due to the increasing number of compatible Interbus 'S' master controllers it would be impossible to create detailed instructions for commissioning the Norgren node on a particular master. All Norgren Interbus products are conformance tested to the latest specification by an independent authorised test site and are fully certified by the Interbus Club. Because of this, the help guide and manual supplied with the users chosen PLC should be used during the commissioning stages of each Norgren node.

Other Related Documents

Interbus Club: Interbus Basics

Related Web Sites

www.interbusclub.com   Interbus Club Organisation

12. AB RIO specification

Norgren RIO systems conform to the Allen-Bradley (RIO) link specification. Communication System: 2-wire RIO protocol

Number of Nodes per Network: Master + 32 slaves

Bus Topology: Line.

Line parameters

Proprietary screened twisted pair cable.

Wiring specification

Belden 9463.

Wiring termination

Terminating resistors must be attached across line 1 and line 2 of the connectors At each end (scanner and last physical device) of the RIO link. The value of the resistor depends on the baud rate and extended node capability as Shown in the following table.

Baud Rate		Terminating resistor size	Maximum cable distance (Belden 9463)
Using extended	All baud	82 ohm 1/2 watt	3048 metres (10,000 ft) at 57.6 kbaud
Node capacity	rates		1524 metres (5,000 ft) at 115.2 kbaud
			762 metres (2,500 ft) at 230.4 kbaud
Not using	57.6 kbaud	150 ohm 1/2 watt	3048 metres (10,000 ft)
Extended node	115.2 kbaud	150 ohm 1/2 watt	1524 metres (5,000 ft)
capability	230.4 kbaud	82 ohm 1/2 watt	762 metres (2,500 ft)

Connections

AB RIO M12 Connector Details	
Pin Number	Signal
1	RIO 1
2	-
3	RIO SH (SHIELD)
4	-
5	RIO 2

Male   Female

Communication in   Communication out

Looking into node connector
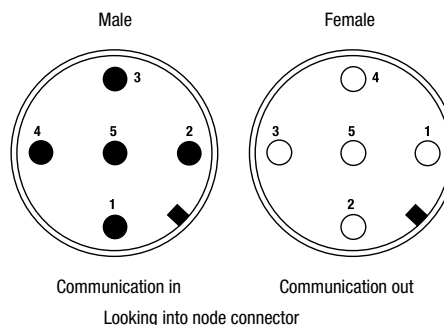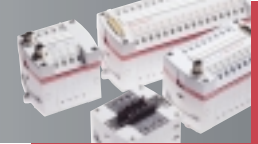
Address and baud rate settings

The VM10 AB RIO node occupies one rack number (address) supporting up to sixteen different rack positions. The table below shows permissible rack numbers for some of the most popular scanner modules.

Rack Number (Address)		
1747-SN	1771-SN	PLC5
Rack 0	Rack 0	Not Vaild
Rack 1	Rack 1	Rack 1
Rack 2	Rack 2	Rack 2
Rack 3	Rack 3	Rack 3
	Rack 4	Rack 4
	Rack 5	Rack 5
	Rack 6	Rack 6
	Rack 7	Rack 7
		Rack 8
		Rack 9
		Rack 10
		Rack 11
		Rack 12
		Rack 13
		Rack 14
		Rack 15

Rotary switches are used to configure the logical rack, baud rate and the rack quarter the valve island appears in for the PLC addressing of the output map. The address switch allows the user to select which logical rack the valve island will appear, this can be configured for any of the first 16 rack positions (most Allen Bradley PLCs only support 4 logical rack positions). The baud rate switch has two functions one to set the communication speed but is also used to set the rack quarter number. This can then be used to select the position within that logical rack enabling the user to place four VM10 valve islands in the same logical rack (see examples). The following baud rates are supported by the VM10 valve island 57.6, 115.2 and 230.4 kbits/sec. The table below shows the switch positions for address and baud rate settings.
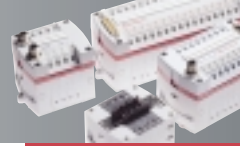
Note: Most masters support Octal addressing while others support a decimal addressing system, please refer to you PLC manufacturers documentation. Only 16 addresses are permitted on one scanner module unless running at the highest baud rate, 32 maybe connected.

AB Rio addressing		Norgren rotary switch settings				
			BAUD/Rack position switch			
Logical Rack	Rack Qtr.	Address switch	57.6k	115.2k	230.4k	230.4k
0	1st	0	0	1	2	3
1	1st	1	0	1	2	3
2	1st	2	0	1	2	3
3	1st	3	0	1	2	3
4	1st	4	0	1	2	3
5	1st	5	0	1	2	3
6	1st	6	0	1	2	3
7	1st	7	0	1	2	3
8	1st	8	0	1	2	3
9	1st	9	0	1	2	3
10	1st	A	0	1	2	3
11	1st	B	0	1	2	3
12	1st	C	0	1	2	3
13	1st	D	0	1	2	3
14	1st	E	0	1	2	3
15	1st	F	0	1	2	3
0	2nd	0	4	5	6	7
1	2nd	1	4	5	6	7
2	2nd	2	4	5	6	7
3	2nd	3	4	5	6	7
4	2nd	4	4	5	6	7
5	2nd	5	4	5	6	7
6	2nd	6	4	5	6	7
7	2nd	7	4	5	6	7
8	2nd	8	4	5	6	7
9	2nd	9	4	5	6	7
10	2nd	A	4	5	6	7
11	2nd	B	4	5	6	7
12	2nd	C	4	5	6	7
13	2nd	D	4	5	6	7
14	2nd	E	4	5	6	7
15	2nd	F	4	5	6	7
0	3rd	0	8	9	A	B
1	3rd	1	8	9	A	B
2	3rd	2	8	9	A	B
3	3rd	3	8	9	A	B
4	3rd	4	8	9	A	B
5	3rd	5	8	9	A	B
6	3rd	6	8	9	A	B
7	3rd	7	8	9	A	B
8	3rd	8	8	9	A	B
9	3rd	9	8	9	A	B
10	3rd	A	8	9	A	B
11	3rd	B	8	9	A	B
12	3rd	C	8	9	A	B
13	3rd	D	8	9	A	B
14	3rd	E	8	9	A	B
15	3rd	F	8	9	A	B
0	4th	0	C	D	E	F
1	4th	1	C	D	E	F
2	4th	2	C	D	E	F
3	4th	3	C	D	E	F
4	4th	4	C	D	E	F
5	4th	5	C	D	E	F
6	4th	6	C	D	E	F
7	4th	7	C	D	E	F
8	4th	8	C	D	E	F
9	4th	9	C	D	E	F
10	4th	A	C	D	E	F
11	4th	B	C	D	E	F
12	4th	C	C	D	E	F
13	4th	D	C	D	E	F
14	4th	E	C	D	E	F
15	4th	F	C	D	E	F

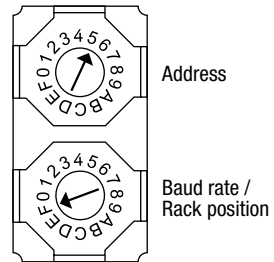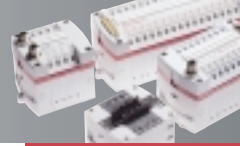## Switch settings examples:

A Valve island configured to the 1st quarter of logical rack 0 with a baud rate of 230.4Kbs would have the following switch setting:
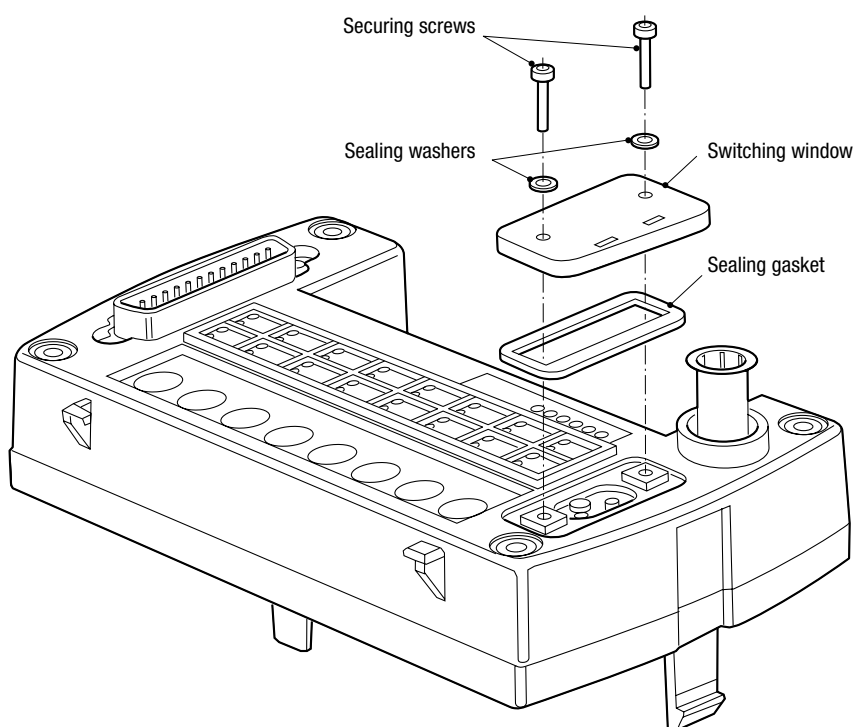
Address

Baud rate / Rack position
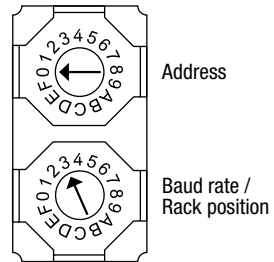
A Valve island configured to the 4th quarter of logical rack 5 with a baud rate of 230.4Kbs would have the following switch setting:
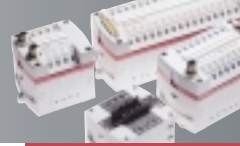
Address

Baud rate / Rack position

	Position within rack	Bit number (decimal)	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Logical rack 0	QTR 1	Word 0	Norgren VM10 valve island example 1
		Word 1																
	QTR 2	Word 2																
		Word 3																
	QTR 3	Word 4																
		Word 5																
	QTR 4	Word 6																
		Word 7																
Logical rack 1	QTR 1	Word 8																
		Word 9																
	QTR 2	Word 10																
		Word 11																
	QTR 3	Word 12																
		Word 13																
	QTR 4	Word 14																
		Word 15																
Logical rack 2	QTR 1	Word 16																
		Word 17																
	QTR 2	Word 18																
		Word 19																
	QTR 3	Word 20																
		Word 21																
	QTR 4	Word 22																
		Word 23																
Logical rack 3	QTR 1	Word 24																
		Word 25																
	QTR 2	Word 26																
		Word 27																
	QTR 3	Word 28																
		Word 29																
	QTR 4	Word 30																
		Word 31																
Logical rack 4	QTR 1	Word 32																
		Word 33																
	QTR 2	Word 34																
		Word 35																
	QTR 3	Word 36																
		Word 37																
	QTR 4	Word 38																
		Word 39																
Logical rack 5	QTR 1	Word 40																
		Word 41																
	QTR 2	Word 42																
		Word 43																
	QTR 3	Word 44																
		Word 45																
	QTR 4	Word 46	Norgren VM10 valve island example 2
		Word 47																
	Position within rack	**Bit number (octal)**	17_8	16_8	15_8	14_8	13_8	12_8	11_8	10_8	7_8	6_8	5_8	4_8	3_8	2_8	1_8	0_8

Securing screws

Sealing washers

Switching window

Sealing gasket

Access to the address switches can be achieved by removing the two securing screws retaining the switch window, it is important to ensure the window is reassembled correctly to ensure the IP65 rating is retained. Manufactures default address is FF.

Indicators

24V (Green) – This LED will only be energised when 24 volts is applied to the valve power terminal of the power supply connector.

5V (Green) – This LED will only be energised when the Network power is connected to the Network connector, indicating that the logic circuit of the module is powered.

Data Active (Green) – This LED indicates the status of the communication connection and is energised when the VM10 valve island is in an operating state.

Data Fault (Red) – This LED indicates the status of the communication layer

Indicator Status During Powering Up and Commissioning

Condition	24V	5V	Status	Data
Power Up	On	On	Single Flash	Single Flash
Device In a Pre-operation State	On	On	Off	Blinking
Device In a Stopped State	On	On	Off	Blinking
Device In an Operation State	On	On	Off	On
Baud Rate Not Support	On	On	On	On

Commissioning

Due to the increasing number of compatible AB RIO master controllers it would be impractical to create detailed instructions for commissioning the Norgren node on a particular master. All Norgren RIO products are conformance tested to the latest specification by an independent authorised test site and are fully certified by Rockwell Automation. Because of this, the help guide and manual supplied with the users chosen PLC should be used during the commissioning stages of each Norgren node.

Related Web Sites

www.rockwellautomation.com   Rockwell Automation

www.ab.com   Allen-Bradley

13. AS-interface specification

Norgren AS-interface Fieldbus systems conform to AS-I V2.11 specification.

Communication System: 2-wire ASi bus communications + electronic & input power.

Number Of Nodes per Network: Master + 31 slaves (63 slaves for V 2.1 slaves which do not use 4 outputs)

Total Number Of I/O Per Network: 248 I/O.

Bus Topology: Tree
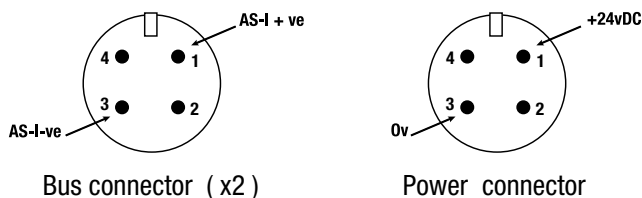
Wiring specification

2-wire unshielded cable (AS-I Bus specific IDC type) or other 2-wire cable with sufficient current capacity.

Similar cable can be used for external power cables.

Line length

100 M including all branches (more possible with repeaters).

Connector details

AS-I + ve
4   1
3   2
AS-I-ve

Bus connector (x2)

+24vDC
4   1
3   2
0v

Power connector

Address and baud rate setting

The addresses of the two As-interface nodes built in to a VM10 valve island are set by using a master controller or hand-held addressing device. Each node has a separate bus connector and are connected to the bus individually to change the default address 0 to the address required. The baud rate is fixed 125Kb.

Address of each valve output.

Some Norgren VM10 valve islands may have two ASi connectors. This is due to the limited number of **outputs** supported by the protocol. See table below for internal addressing of each valve.

Valve Island	Asi Nodes	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8
4 Station Sol/Spg	1	Asi 1.0	Asi 1.1	Asi 1.2	Asi 1.3	N/A	N/A	N/A	N/A
4 Station Sol/Sol	2	Asi 1.0/1	Asi 1.2/3	Asi 2.0/1	Asi 2.2/3	N/A	N/A	N/A	N/A
6 Station	2	Asi 1.0/1	Asi 1.2/3	Asi 2.0	Asi 2.1	Asi 2.2	Asi 2.3	N/A	N/A
8 Station Sol/Spg	2	Asi 1.0	Asi 1.1	Asi 1.2	Asi 1.3	Asi 2.0	Asi 2.1	Asi 2.2	Asi 2.3

Default node address – 0

N.B. Whilst commissioning a valve island with two AS-interface connectors only one network connection should be made until that connection has been given a unique address.

Indicators

24V (Green) – This LED will only be energised when 24 volts is applied to the valve power terminal of the power supply connector.

ASi1 (Green) – This LED will only be energised when the Network power is connected to the Network connector, indicating that the Asi 1 logic circuit of the module is powered.

ASi2 (Green) – This LED will only be energised when the Network power is connected to the Network connector, indicating that the Asi 2 logic circuit of the module is powered.

Diag1 (Red) – The LED Indicates the status of the ASi IC.

Diag2 (Red) – The LED Indicates the status of the ASi IC.

Indicator Status During Powering Up and Commissioning

Condition	24V	ASI 1	ASI 2	Diag ASI 1	Diag ASI 2
Power Up	On	On	On	On	On
Device In a Pre-operation State	On	On	On	On	On
Device In an Operation state	On	On	On	Off	Off

I.D and I/O configuration codes

VM10 Valve island only offer output connections and each size of ASi node are configured to the fewest possible appropiate number of outputs and stores the corresponding ID code. Only one I.D and I/O configuration code are used with the VM10 valve islands.

VM10 ASi I.D and I/O configuration code: FF 08 h (Remote 4 Output)

I.D = FFh (15)

I/O configuration = 8 (4 outputs)

Commissioning

Due to the increasing number of compatible ASi 2.11 master controllers it would be impractical to create detailed instructions for commissioning the Norgren node on a particular master. All Norgren AS-Interface products are conformance tested to the latest specification by an independent authorised test site and are fully certified by the AS-interface international group. Because of this, the help guide and manual supplied with the users chosen PLC should be used during the commissioning stages of each Norgren node.

Related Web Sites

www.as-interface.com   AS-interface International Organisation

www.ad.siemens.de   Siemens Automation and Drive

14. Norgren Bus Communication Protocol

The Norgren bus is a serial communications system developed for the Norgren Fieldbus II system. The bus provides communications between the components of the system and allows configuration in distributed or centralised forms.

Communication System: 2 wire RS485 hardware communication protocol.

Maximum I/O per network: 64 inputs + 64 outputs.

Bus topology: Line from each side of main fieldbus node.

Wiring specification

The bus cable is a 12-core shielded cable (Belden 9506 CMG 6PR24) which carries Communications and configuration signals plus power for the logic circuits, remote input and outputs.

Line lengths

The maximum length of the Norgren bus is 250 metres each side of a central node. The power for electronics and outputs is also contained within the bus cable and the voltage may reduce over long distances due to cable resistance. If this voltage falls below acceptable values (which may happen if many solenoids are turned on) then extra power can be supplied through an additional power connector.
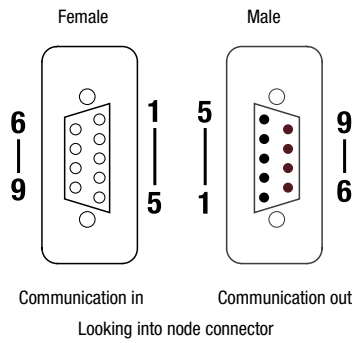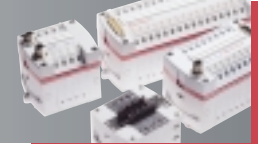
Wiring termination

The Norgren bus requires termination at the extreme ends. This is achieved by using a terminating D connector.

Connections

The Norgren bus is connected using 9-pin "D" connectors.

Pin No	9 Pin Male D-type	9 Pin Female D-type	Colour	Note
1	24 Volt output / valve	24 Volt output / valve	Red & Brown	Twisted Pair
5	0V24	0V24	Black(Red) & Black(Brown) &Black (White)	
4	24 Volt Electronics	24 Volt Electronics	White	Twisted Pair
2	5 Volt	5 Volt	Blue	Twisted Pair
3	0V5	0V5	Black(Blue)	
9	A	A	Green	Twisted Pair
7	B	B	Black(Green)	
8	Config Out	Config In	Yellow	Twisted Pair
6	Config Rtn	Config Rtn	Black(Yellow)	
	Shell	Shell	Screen	

Female   Male

6 — 9   1 — 5   5 — 1   9 — 6

Communication in   Communication out

Looking into node connector

Distributed System Cables

The cables that are used to connect the various V20/22 and VM10 modules together are available in three lengths:

|	
1m Interconnection Cable	VE2FBC9P-9S010
3m Interconnection Cable	VE2FBC9P-9S030
5m Interconnection Cable	VE2FBC9P-9S050

Address and baud rate setting

A Norgren Fieldbus II system can consist of V20 and V22 valve islands , I/O modules and VM10 valve islands in any combination and position and are connected to the main Fieldbus node either directly or through serial cables.

Before use the node has to be configured in order to determine what components are present on the bus and allocate addresses to the inputs and outputs.

This is initiated by switch 10 on the underside of the node which when moved from it's current position to the other will cause the node to perform a configuration cycle which interrogates the system and allocates I/O.
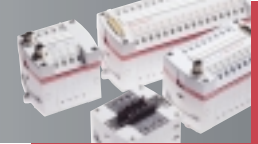
Address of each valve output

The address bit of each output can change within a FieldbusII system dependant on which side of the node and where in the system the valve island is connected. See examples below.

A 6 station VM10 valve island configured on the right hand side of the FieldbusII node:

NODE	0	2	4	6	8	10	Solenoid 1-4
	1	3	5	7	9	11	Solenoid 1-2

A 6 station VM10 valve island configured on the left hand side of the FieldbusII node:

Solenoid 1-4	0	2	4	6	8	10	NODE
Solenoid 1-2	1	3	5	7	9	11	

Indicators

Status (Red/Green) – This LED indicates the status during the configuration of the Norgren Fieldbus II System

Indicator Status During Powering Up and Commissioning

Condition	Status
Power Up	Flash Green / Red
Device In a Pre-operation State	Green
Un-configured (No Assigned Address)	Flashing Red
Device In an Operation state	Off

Commissioning

Please refer to the Norgren Fieldbus II documentation 10975-C01 supplied with all Norgren Fieldbus II systems.

Appendix

Testing for correct bus termination

The bus connectors should be unplugged from all Fieldbus devices in the segment. Where this is not possible in exceptional cases (e.g. the bus cables are permanently attached to repeaters), the cables must be removed and temporarily connected together to ensure continuation of the incoming and outgoing data wires and shields.

Generally speaking, measurements can be made without opening up the bus connectors, although - depending on the bus connector type - this may still be necessary at the two ends of the segment to allow access to the terminating resistors.

A voltage measurement is first made at the one end of the segment between the A and B wires to ensure that no voltage is present. If a voltage can be detected, it is likely that an active device (e.g. repeater or Fieldbus device) is still connected to the bus segment. All active devices must be unplugged from the bus segment during the following resistance measurements!

Provided that no voltage is present on the bus, a resistance measurement should be carried out to check whether additional terminating resistors are unintentionally connected to the segment.

During this test, the bus terminating resistors must be removed from both ends of the segment.

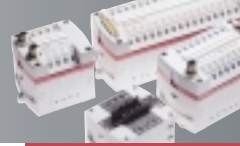Standard bus termination connects a resistor between the communication wires.

If the test measurements shows an open circuit between the communication wires, the cable segment is correctly installed, other possibilities are as follows:

Measured value R < 220 ohms: One or more additional terminating resistors are inserted in the segment or there is a short circuit between the A and B wires

Measured value R > 220 ohms to < 330 ohms: If the segment length is max. 10000 m, one additional 220 ohm terminating resistor is inserted in the segment. The approximate distance X in m of the terminating resistor from the measurement point can then be calculated with $X = 1000 * (R - 220) / Rs$.

All additional terminating resistors should be removed from the bus segment.

Indicator states and flash rates