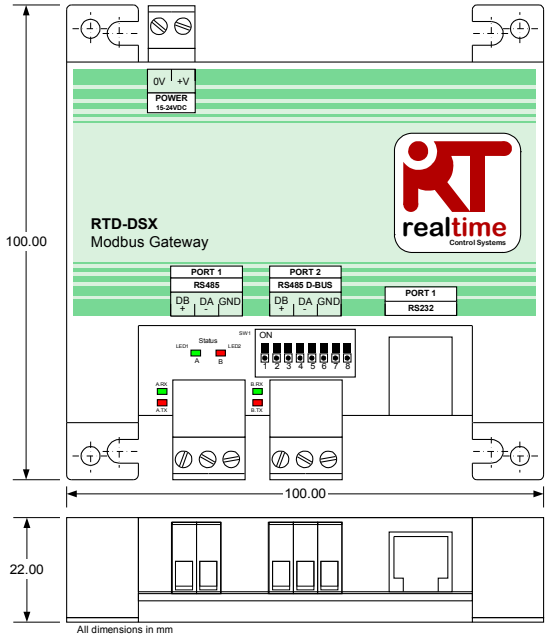
RTD-DSX v1.02

Installation and Operating Instructions



Description

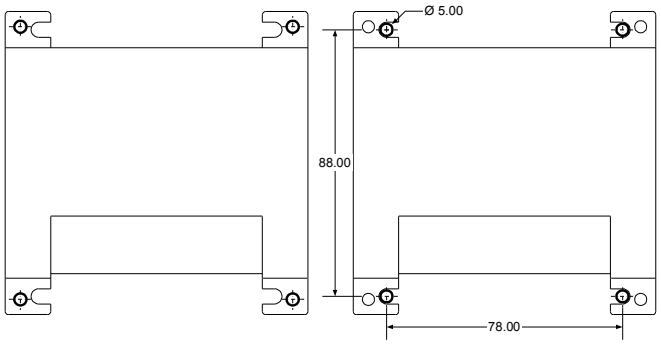
The DSX-Gateway is a Modbus monitoring and control interface for RealTime Control Systems products that support the D-Bus and Modbus protocols. The DSX-Gateway allows the connection of a Modbus Master to a network of devices without interfering with inter-device D-Bus communications.

The Gateway allows access to the Modbus registers on all attached D-Bus network devices through a series of mapped Modbus addresses. Multiple DSX-Proxies can be networked together to map a large number of D-Bus network devices onto a Modbus network.

Warnings and Cautions

Observe precautions for handling Electrostatic Sensitive Devices

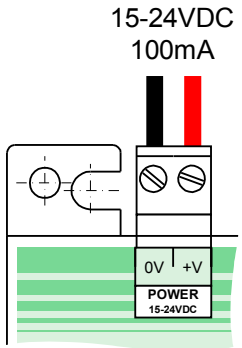
Mounting



The DSX can be mounted in purpose built enclosures using plastic standoffs mounted in the mounting holes show in the left-hand figure. The DSX can also be mounted using screw fixing using the mounting points indicated in the right-hand figure.

Power Supply

The DSX is powered from a 15-25VDC, 100mA supply as shown in the diagram to the left.



RS485 Network Specification

CABLING

Use stranded 24awg shielded or unshielded twisted pair to Cat3, Cat4 or Cat5 specification. Use a twisted pair for connections DB,DA and an extra core for connection GND. Use a cable with different coloured cores and follow the same wiring colour order on all terminals.

NETWORK LENGTH

Standard installation for total network distances of up to 500m can be achieved following the basic daisy-chaining method showed in the above diagram. The network can be extended further using DSX-Gateways.

TERMINATION

The DSX operates at network speeds of up to 19200. For these network speeds RS485 termination is not usually necessary.

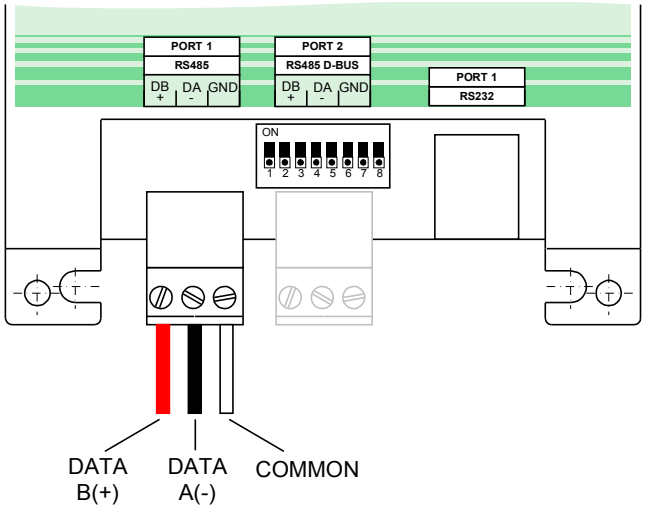
External Port 1

Port 1 is the External interface port that connects the DSX to the external control system, e.g. a Modbus Master.

Port 1 allows either RS485 or RS232 connections to be made to the DSX (simultaneous RS232 and RS485 operation is not supported).

Port 1 RS485 Mode

The RS485 connection on Port 1 allows the DSX to be networked together as part of a daisy-chained RS485 network of Modbus or D-Bus devices. The DSX can be networked together with other DSX devices or other 3rd Party Modbus devices and connect to an RS485 Modbus Master.



RS485 Twisted Pair + Common

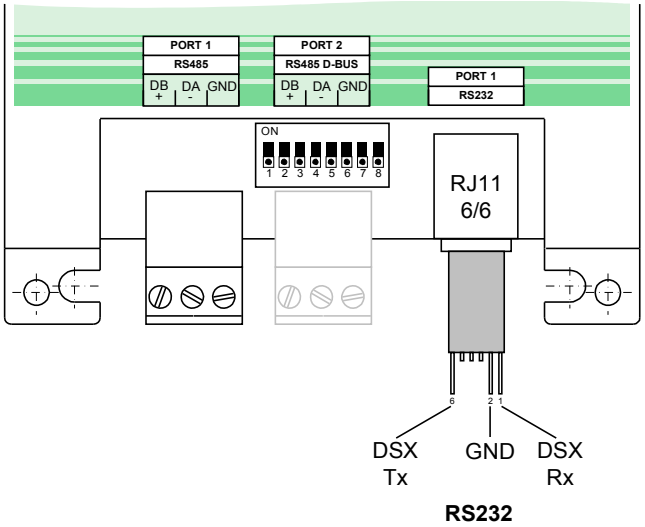
The RS485 D-Bus network requires a twisted-pair cable connecting terminals DB(+) and DA(-) on each DSX as shown above. Terminal DB must be connected to DB(+) terminals on other devices. Terminal DA(-) must be connected to DA(-) terminals on other devices. In addition the common terminal GND on all devices must be connected together. If a shielded cable is used then the shield can be used for this purpose. It is recommended that the GND connection is connected to a local Earth at one point only. The network must be installed as a daisy-chained point-to-point Bus configuration, Star and Ring connections must NOT be used.

It is recommended that a wiring convention is followed in which the Data A(-) terminals are wired with Black cores, and the Data B(+) terminal are wired in an alternate core colour such as Red.

PORT 1 NETWORK SPEED

Port 1 RS232 Mode

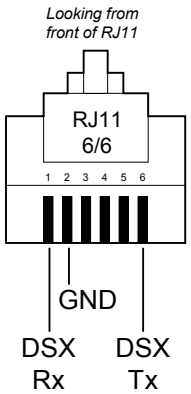
The RS232 port is a 6/6 RJ11 port that allows a point-to-point connection between a Modbus Master and the DSX External Port. RS485 Operation on Port 1 is NOT supported if the RS232 port is active.



RS232

CABLING

The cable should be a 6 way flat telecoms type (e.g FCC 68) cable with a maximum length of 3m. The cable should be terminated at the DSX using a crimped RJ11 6/6 plug. The wiring and pinout for the cable and plug are shown in the adjacent diagrams,



OPERATION

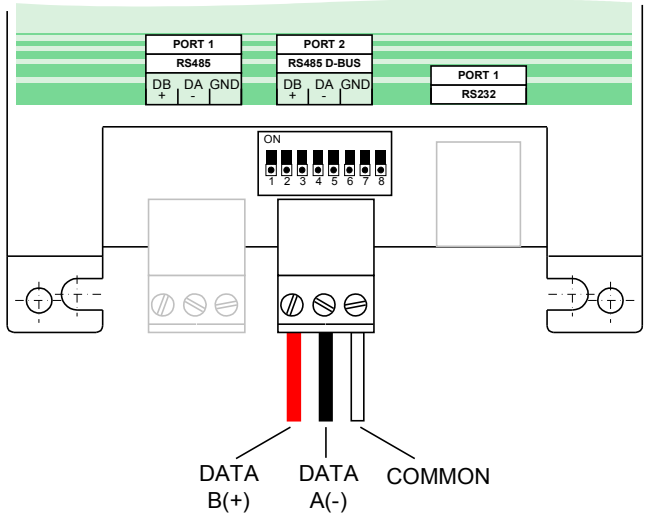
The RS232 port is a 3 wire connection consisting of TX, RX and GND. The DSX RX should be connected to the Modbus Master TX and the DSX TX should be connected to the Modbus Master RX.

There is no hardware or software flow-control. The baud rate is the same as for the RS485 option, 19200 default with 9600 selected using SW1.1.

Local Port 2

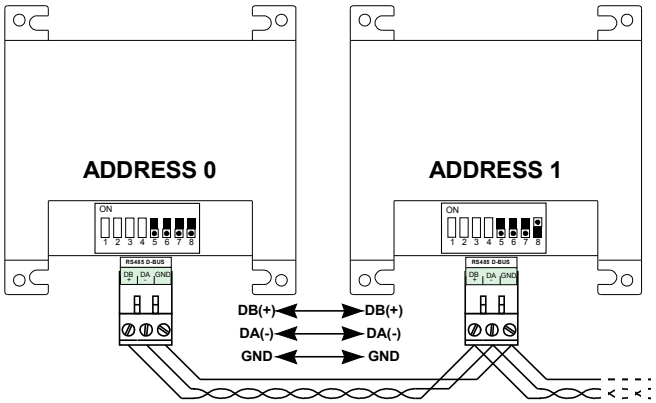
Port 2 is the Local interface port that connects the DSX to local control networks. Port 2 is an RS485 network.

Cabling requirements are the same as for Port 1.



RS485 Twisted Pair + Common

Multiple devices are daisy chained together as with the Port 1 RS485 port by connecting corresponding terminals on devices in series as shown in the diagram below.

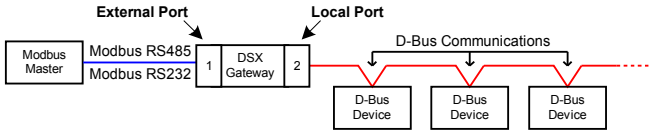


Level 1 Network Applications

Applications of RealTime products such as Duty/Standby control use the D-Bus protocol to communicate between devices. This mode of operation prevents direct connection of a Modbus Master to the device network.

SINGLE D-BUS NETWORK GATEWAY

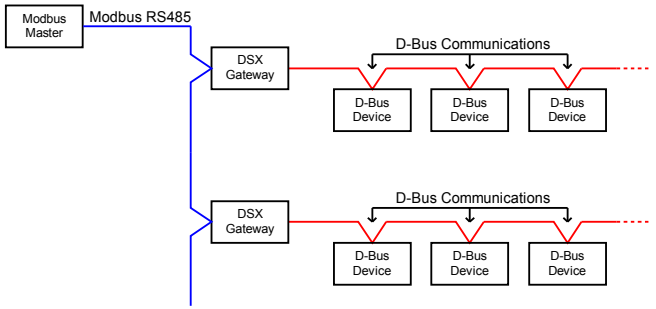
Connecting a DSX Gateway to the D-Bus Network on the DSX Local Port (Port 2) allows a Modbus Master to communicate with the D-Bus devices using either RS232 or RS485 via the External Port (Port 1).



In this configuration each DSX can be connected to a D-Bus network of up to 15 devices.

MULTIPLE D-BUS NETWORK GATEWAY

In the case of several D-Bus networks, multiple DSX Gateways can be employed to access all devices from a single Modbus Master using an RS485 network on the External Port.

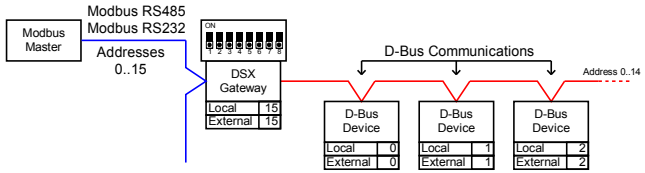


Each DSX Gateway performs *Address Mapping* to allow a single Modbus Master to uniquely address the devices on different D-Bus networks.

This configuration also allows a mixture of 3rd party Modbus Slave devices and DSX Gateways to be combined on a single RS485 Network. The DSX External Port Baud rate can be configured to operate at 19200 or 9600 to match the configuration of other Slaves and the Modbus Master. See the *Port Configuration* section for further details.

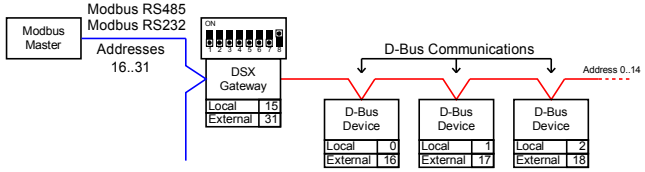
Level 1 Configuration

A single Level 1 DSX installation consists of a D-Bus network of up to 15 devices with addresses set in the range 0 to 14 connected to the DSX Local Port.

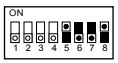
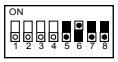


The DSX External Port is connected to a Modbus Master using either RS232 or RS485. With the DIP switches configured in the above diagram, no Address Mapping occurs and the D-Bus devices appear as Modbus Addresses 0 to 14.

Mapping D-Bus address 0 to Modbus Address 0 is not always possible as the Modbus Standard specifies a valid address range of 1 to 247. Setting DIP Switch SW1.8 ON causes the DSX to map the address range to a block starting at Modbus Address 16.



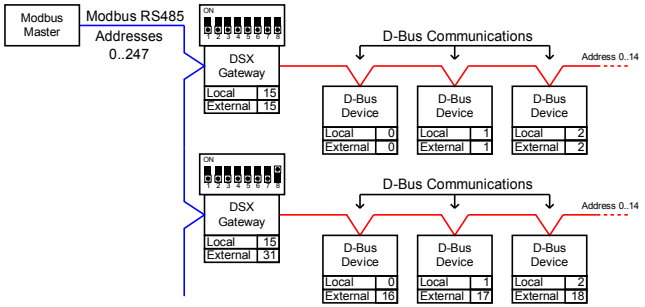
The address switches SW1.4 to SW1.8 can be used to map the address into the following ranges.

DIP Switch	Modbus Address	Mapping	DIP Switch	Modbus Address	Mapping
	0..14	Local 0 → Modbus 0		128..142	Local 0 → Modbus 128
	16..30	Local 0 → Modbus 16		144..158	Local 0 → Modbus 144
	32..46	Local 0 → Modbus 32		160..174	Local 0 → Modbus 160
	48..62	Local 0 → Modbus 48		176..190	Local 0 → Modbus 176
	64..78	Local 0 → Modbus 64		192..206	Local 0 → Modbus 192
	80..94	Local 0 → Modbus 80		208..22	Local 0 → Modbus 208
	96.110	Local 0 → Modbus 96		224..238	Local 0 → Modbus 224
	112..126	Local 0 → Modbus 112			

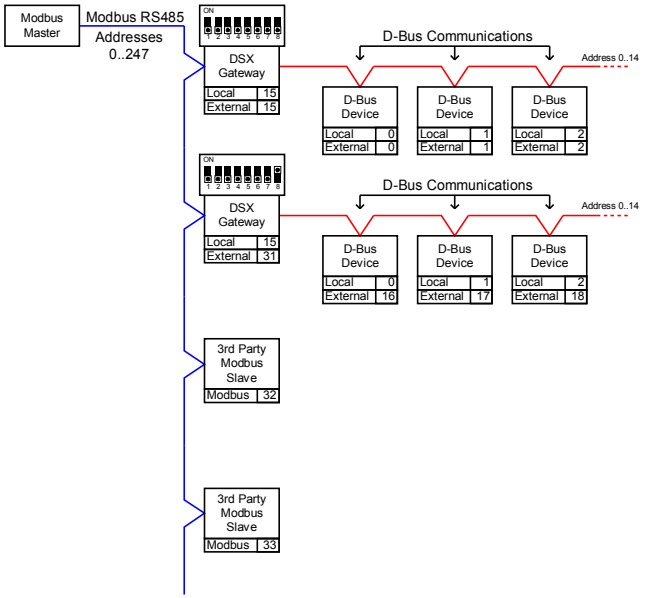
Level 1 Multiple DSX Configuration

With Port 1 operating in RS485 mode, multiple DSX gateways can be added to the External Network providing each DSX gateway is configured to map into a separate Modbus address range.

Each DSX Gateway must be configured with a different address map range as defined in the previous table.



If 3rd party Modbus devices are added to the External Modbus network the addressing of these devices and the DSX Gateways must be configured so that there are no address clashes. The baud rate and parity must also be configured the same on all devices.

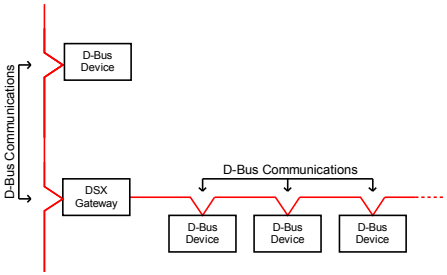


Level 2 Network Applications

Some RealTime devices allow a single RealTime D-Bus device to manage a large number of other D-Bus devices in a control network. The DSX-Gateway allows large numbers of devices to be added using address mapping.

ADDRESS EXTENSIONS

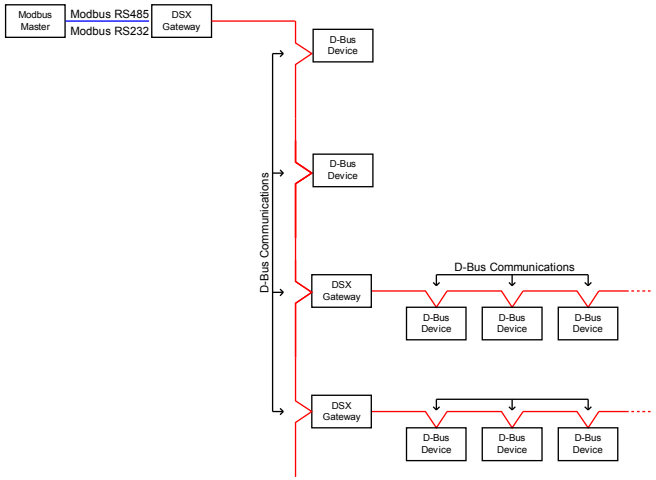
In D-Bus applications where a D-Bus *Primary* device can be configured to extend its address range, additional D-Bus devices can be added in extended address blocks by adding-DSX Gateways and using the DSX *Address Mapping* function.



In this configuration both the External and the Local Network of the DSX-Gateway operate in D-Bus mode, this means that a Modbus Master cannot be added to the External Network as Level 1.

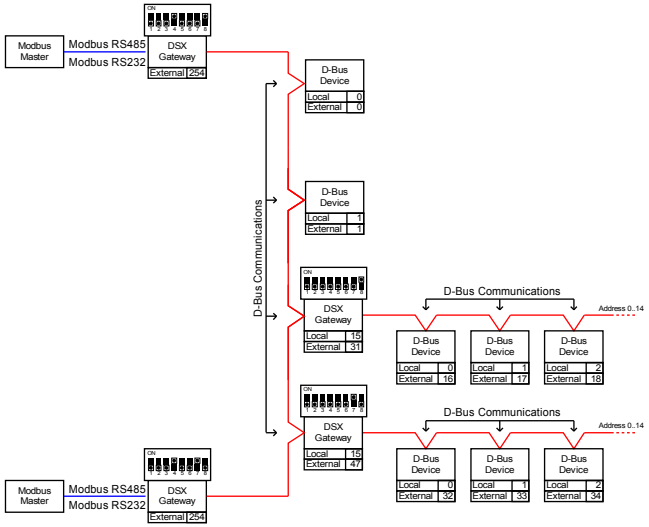
LEVEL 2 MODBUS MASTER

An additional DSX Gateway can be added to the external D-Bus network to map all of the devices to unique Modbus Addresses. In this case there are two levels of D-Bus network, so the configuration is referred to as a *Level 2* D-Bus network.



Level 2 Network Configuration

D-Bus devices that address more than 15 devices can be extended to cover larger address ranges by using Level 1 DSX Gateways for Address Extension. Each DSX Gateway will allow a block of an additional 15 devices to be added to the control network of a D-Bus Primary Controller. In this configuration the External Network becomes a D-Bus network, therefore to connect to the network using a Modbus Master requires a DSX Gateway.



In this configuration the DSX Gateway is configured as a Network Level 2 gateway using DIP SW1.3 and SW1.4. The address mapping results in the same Modbus address mapping as defined in the Network Level 1 section.

In this configuration more than one Modbus Master can be added to the network by selecting a unique Level 2 address using SW1.5 to SW1.8

DSX Network Level

DIP Switch SW1.3 and SW1.4 configure the DSX Network Level. The default is Network Level 1 in which the DSX Local port will access a network of up to 15 devices with D-Bus addresses 0 to 14.

Network Level 2 extends the DSX to map D-Bus addresses up to 247 mapped directly to Modbus addresses.

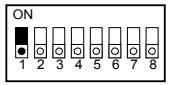
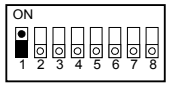
	Network Level 1	Up to 15 devices on local network in range 0..14
	Network Level 2	Up to 248 devices on local network in range 0..247

Port Configuration

Ports are configured by default to **No Parity, 1 Stop bit** with a Baud rate of **9600 or 19200**.

DIP switch SW1.1 selects the speed of the Ports except for the Local Port at Network Level 1 which is not affected by SW1.1 and has a default speed of 9600.

The following speeds are selected by SW1.1

	19200, No Parity, 1 Stop Bit
	9600, No Parity, 1 Stop Bit

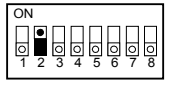
The port speeds at selected Network Levels are defined as follows:

	External Port 1	**Local Port 2**
Network Level 1	SW1.1: OFF=19200 ON = 9600	Fixed 9600
Network Level 2	SW1.1: OFF=19200 ON = 9600	SW1.1: OFF=19200 ON = 9600

The speed and parity of the Ports can be further customised using Field Programming tools available from RealTime.

Address Offsetting

DIP Switch SW1.2 allows an Address Offset of 1 to be added to addresses. With Address Offsetting enabled, addresses 0 to 127 on the D-Bus network attached to Port B of the DSX will be mapped to address 1 to 128 on Port A.

	No offset	
	Address Offset	Address 0..127 on Port B are mapped to Address 1..128 on Port A

Functional Specification

Electrical

Supply	15V-24V DC, 100mA
Power	<2.5VA
Dimensions	H100 x W100 x D22 mm
Mechanical	
Mounting	Four screw / pillar mounts
Casing	Zinc coated mild steel
Weight	120g
Connectors	Rising clamp to 0.75mm^2 cable

Environmental

Temperature	
Storage	-10oC to 50oC
Operation	0oC to 50oC
Humidity	0-90% RH non-condensing
Protection	IP30
EMC Emissions	EN61000-6-1
EMC Immunity	EN61000-6-3