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MHUBX8 Rev. E
8-PORT RS485 REPEATER HUB (non-isolated) with an
RS232/RS485 MASTER PORT

The **MHUBX8** is an 8-port automatic RS485 repeater hub (non-isolated) with a master RS232/RS485 port. The unit can be used to expand RS485 serial communications networks by increasing the maximum distance and/or number of nodes. Data received by the master port is transmitted to all eight distribution ports (CHA thru CHH). Data received into a distribution port is transmitted out the master port, but is **NOT** transmitted out any other distribution port. Each distribution port has its own termination jumper and an RXEN (receive enable) jumper. Bias is fixed with 620 Ohms of pull-up and pull-down resistance to hold the data lines in a known state when the data lines are inactive. Each distribution port on the **MHUBX8** hub will support up to 32 full-load RS485 devices. Additional units/nodes can be added, using 1/2(64 units) and 1/4(128 units) load devices. The SP485EEP transceiver IC, employed in the **MHUBX8**, is a 1 load device, has built-in 22-OHM protection resistors, and is capable of communicating at speeds up to 230.4Kbps++ using the RS485 master port and 115.2Kbps using the RS232 master port. Speeds up to 921.6Kbps are possible using the RS485 master port with about a 25uSec turn around delay from transmit to receive mode.

Very large networks, consisting of many nodes, and/or extended distances, can be formed by cascading **MHUBX8** units in various configurations. In the simplest example, the hub can be connected to 8 "home run" devices or networks. With proper termination, at the far end of the "home run", each "home run" can be up to 4000 feet long. In a similar configuration, two "home runs" can be connected to each port by removing the termination jumper on that port, and providing termination at each of the two devices at the far ends of the "home runs". This allows 16 "home run" units/networks to be connected to the hub. As long as the total distance of the two "home runs" connected to one port is less than 4000 feet, and the devices connected to these do not impose more than 32 unit loads, the RS485 distance/loading specifications are not violated. As noted above, bias for devices connected to a distribution

port on the **MHUBX8** is provided by the **MHUBX8**. In either of these two simple configurations up to 256 1 unit loads/nodes can be connected using only one **MHUBX8** repeater.

If additional **MHUBX8** repeaters are cascaded on the distribution ports of the base **MHUBX8** repeater, the number of total nodes, which communicate with the master port on the base **MHUBX8** unit, is essentially unlimited. For example 9 **MHUBX8** repeaters can support up to 2048 nodes. Another example would be to use an **IBS485HV** 5-port isolated repeater for the master hub and 5 **MHUBX8** for additional distribution for up to 1280 devices on 5 isolated legs. Note: This configuration would require 6 individual power supplies to maintain the isolation. Please call Ron at 513-874-4796 or 513-638-0228 Cell, for additional information.

However, once an RS485 network exceeds about 32 nodes on a network, serious consideration should be given to using galvanic isolation. Even though some IC manufacturers offer light loading devices, that can accommodate 256 or even 400 nodes on one RS485 network, you may **NOT** want to build such a network for a few reasons. One reason is that, large networks accumulate distributed electrical noise, which can make communications unreliable. In general it is very important not to run communications wires in the same trough or conduit or in parallel with AC power cables. Maintain as much distance as possible and cross any power cable at a right angle. While shielding is not specified for RS485 systems, it can help in many instances. By "isolating" sections of a large network, the accumulated noise on one isolated leg is not so likely to cause a data error that will propagate to another leg of the network. Galvanic isolation will break a large problem into several small, but manageable ones. Galvanic isolation can also help eliminate "ground loops."

Another potential problem with large networks without isolation, is that severe damage can occur to your entire system, if a high voltage source is connected (accidentally or otherwise) to your communications lines. Your entire network could be damaged. With galvanic isolation the damage is generally limited to only one leg of the network, except in extreme cases of very high voltage (induced by lightning for example). While it goes against conventional wisdom, and can potentially cause a problem with circulating currents by grounding a shielded cable at both ends, this method is very effective at keeping induced lightning noise away from the communications lines. In the alternative, ground one end of the shield and connect the other end to ground through a bi-directional transient protector (from a few volts to a few hundred volts depending on the situation). R.E.Smith also provides an extensive line of optical/transformer isolated repeaters and multi-port repeaters as well as a series of fiber optic products which provide very high isolation. These products are extremely effective in applications involving industrial control, large RS485 networks, outdoor data links between buildings, etc. Please see out new **SMFCOMX Fiber Optic Platform (20+ Configurations)**.

An onboard switching regulated power supply will accept 9-35VDC input power. Typical power usage is about 1.25W with a maximum of 2.0W. A 12Vdc switching and regulated power supply is available from R.E. Smith as an optional accessory. Power can be applied to either screw terminals or to a 2.1mm connector with center positive. A reverse polarity diode protect the unit from operating the polarity is reversed.

Because the **MHUBX8** master port is both RS232 and RS485 compatible, you can communicate with the devices connected to the distribution ports in either protocol. This allows a convenient way to connect the **MHUBX8** to a desktop computer or laptop without the need for a separate RS232↔RS485 converter. You can also trouble shoot an active network by connecting a monitoring computer to the master port which is not being used for control. For

example, if the network control is thru the **MHUBX8** RS485 master port, by connecting a laptop, or other computer, with an available serial port to the **MHUBX8** RS232 master port you can monitor the data that is received into CHA thru CHH. Data cannot be sent from the monitoring computer in this mode or a data collision could occur with data coming into the master RS485 port. However; if the master RS485 port is disconnected so that no data collision can occur, full operation and control can be done thru the master RS232 port on the **MHUBX8**. Transmit control on the **MHUBX8** RS485 ports is fully automatic, and will work at baud rates from 300-115.2Kbps (up to 230/4Kbps++ in RS485 only mode).

In general RS485 is designed for multi-drop, "daisy-chain" operation over a single twisted pair cable with a nominal characteristic impedance of 120 Ohms. This cable is usually 24AWG. Category-5 cable will generally work well in most instances even though its characteristic impedance is 100 Ohms. "Tap points" or "T" connections should be short to eliminate reflections. It is possible to connect several RS485 circuits in parallel if the distances are below about 200 feet per leg @ 9600bps. At greater distances and higher data rates, the cable impedances add up and load the network. In addition there is no good way to add termination resistors at the ends of a "star" network. The combination of the cable impedances and/or termination resistors will load the network and can make communications unreliable. The **MHUBX8** can be used to eliminate these speed and distance problems in a star configuration.

If a remote node on a large network turns on its transmitter, and then for some reason loses control, and will not turn off, this one device could "lock-up" the entire network. By removing the RXEN (receive enable) jumper associated with the channel connected to the unit that will not turn off, normal operation can be restored to the rest of the network while the problem is being fixed.