OMNI Flow Computers, Inc

Last Updated: 09-April-2009 TB-980401B

Peer-to-Peer Basics

TECHNICAL BULLETIN

NOTES: **User Manual Reference – This Technical Bulletin complements the information contained in User Manual, and is applicable to all firmware revisions Version .74+.**

This is an updated edition that replaces previously published bulleting under the same title.

See the following: TB-980402 – Using the Peer-to-Peer Function in a Redundant Flow Computer Application; Volume 1 – 1.6.3 Serial Communication Modules.

Peer-to-Peer Communication – The Peer-to-Peer communication features allows you to multi-drop up to 32 flow computers and other devices in RS-485 serial communications mode, and up to 12 using RS-232-C communications.

Peer-to-Peer Redundancy Schemes – Redundancy schemes allow for uninterrupted measurement and control functionality by interconnecting to identically equipped and configured flow computers.

Table of Contents

Figure

NOTE: Getting Support – Support is available at: Phone: (281)240-6161
Email should be sent via the WEB Page at: www.omniflow.com
or email to: helpdesk@omniflow.com

Scope

All firmware revisions Version .70+ of OMNI 6000/OMNI 3000 Flow Computers have the Peer-to-Peer Communication feature.

Abstract

Communications between OMNI Flow Computers is accomplished using the *peer-to-peer* function. This function is available only on Serial Port #2 with data being transmitted and received using Modbus RTU protocol. A data transaction list within each flow computer defines each Read or Write operation to be transacted for that computer. A maximum of 16 transactions per flow computer are available. The transaction list must be contiguous (i.e., an empty transaction will be treated as the end of list).

Two optional serial communication I/O modules are available with your flow computer: the RS-232-C (compatible) Model #68-6005, and the RS-232-C/RS-485 Model #68-6205. The older Model #68-6005 is only capable of RS-232 compatible serial communications. The newer Model #68-6205 is capable of either RS-232 or RS-485 communications via a selection jumper. When jumpered for RS-232, the characteristics and functionality of this module is identical to that of the older RS-232-C module.

Determining Which Computer Will Be Master

Each flow computer wishing to communicate must temporarily become a Modbus Master so that messages may be initiated and its transaction list processed. This is accomplished when the current Modbus Master completes its transaction list and broadcasts the Modbus address of the next computer to be the master. The computer with the Modbus ID which matches the broadcast then assumes mastership and proceeds to process its transaction list. A time-out occurs whenever the next master in sequence does not take mastership and the broadcast will be retried once. Should the computer still fail to respond, the current master will attempt to pass mastership to the next computer in sequence by incrementing the Modbus ID by one and re-broadcasting the new Modbus ID. Each flow computer needing to process a transaction list (i.e., be a master) requires the following three entries: (1) Next Master in Sequence; (2) Last Master in Sequence; and (3) Retry Timer (50mS ticks).

These entries are in the Peer-to-Peer Setup menu and function as follows:

Entry 1: This entry is the Modbus ID for the next flow computer master. ***A non zero entry here is what actually turns on the peer-to-peer function***. Modbus ID's for master devices in the link **must** be assigned starting at 1, and for maximum efficiency not contain any missing ID's (i.e., 1, 2, 3, 4, **Not** 1, 3, 6, 10, for instance).

Entry 2: This entry is the Modbus ID for the last flow computer master. Any master failing to find the 'next master' will keep trying Modbus ID's until it reaches this ID it will then start the search again at Modbus ID 1.

Entry 3: This entry is used to setup the communication retry rate. When the peer-to-peer link is solely comprised of OMNI flow computers this entry should be set to 3 ticks (150 msec).

Communication Settings for the Peer-to-Peer Link

The following settings **must** be used:

- Modbus RTU Protocol
- 8 Data Bits
- 1 Stop Bit
- No Parity

While slower baud rates can be used, 38.4 kbps or 19.2 kbps will provide maximum performance.

Foreign Modbus Devices and Single Master Systems

NOTE: INFO – It is important to note that in a peer-to-peer system, only the flow computers that have a non-zero entry for the 'Next Master in Sequence' are limited to using Serial Port #2, all of the other flow computers are simply acting as Modbus slaves and can use any valid Modbus serial port.

The peer-to-peer function is not limited to multiple OMNI Flow Computers. Some applications simply require a single flow computer master to communicate with a variety of Modbus slave devices which may be flow computers, PLC's etc. In these cases, the entries 1 and 2 above would be set to 1 in the master flow computer only, signifying only one master is in the system. Entry 3 above would normally be set to 3 but may need to be increased depending upon the message response time of any foreign Modbus devices in the system.

Wiring Options

RS-232-C Wiring Requirements

NOTE: INFO – The OMNI Flow Computer uses a proprietary 'tri-statable' RS-232-Compatible serial port, which unlike a normal RS-232 port, can be multi-dropped, interconnecting up to 12 flow computers or other serial devices.

The following diagram shows the wiring requirements using the RS-232-C termination option. When multiple flow computers are used as peer-to-peer masters, they are connected in two-wire, multi-drop mode (Figure 1).

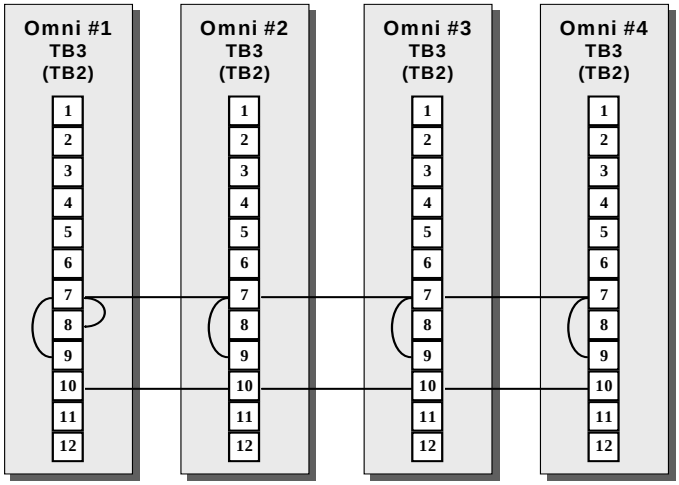


Figure 1. OMNI 6000 (3000) Peer-to-Peer Wiring Requirements using RS-232-C Termination Option

RS-232 to RS-485 Converter Wiring Requirements

Figure 2 diagram shows a typical installation, where two flow computers are connected to a PLC via an RS-232 to RS-485 converter module.

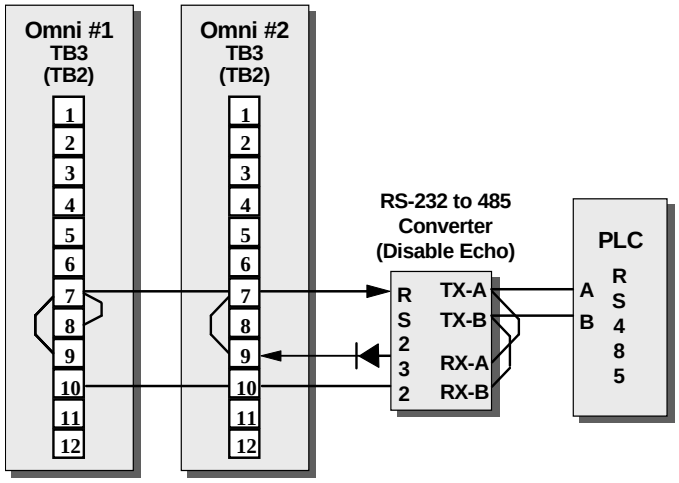


Figure 2. OMNI 6000 (3000) Peer-to-Peer Wiring Requirements with PLC using a Standard RS-232 to RS-485 Converter Module

RS-485 Wiring Requirements

NOTE: Multivariable Transmitting Devices – In addition to the Serial I/O Module # 68-6205, the flow computer must also have an MV Module to communicate with multivariable transmitters. This serial module is jumpered to IRQ 3 when used in combination with an MV Module. Without an MV Module, the jumper is placed at IRQ 2. The MV Module can only be used with this serial module (68-6205) and is not compatible with the Serial I/O Module # 68-6005. For more information refer to TB-980303.

Figure 3 shows a typical peer-to-peer installation using RS-485 communications, where four flow computers are interconnected in a two-wire, multi-drop mode.

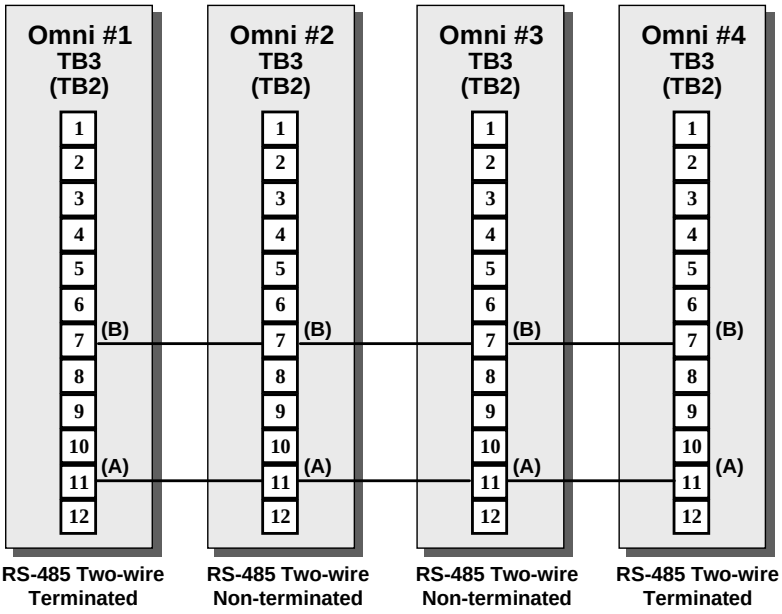


Figure 3. OMNI 6000 (3000) Peer-to-Peer Wiring Requirements using the RS-485 Two-wire Multi-drop

The peer-to-peer communication link may also be used to transfer data to and from any other Modbus slave device such as a PLC. The following diagram shows a typical installation using RS-485 where two flow computers are connected to a PLC in a two-wire, multi-drop mode.

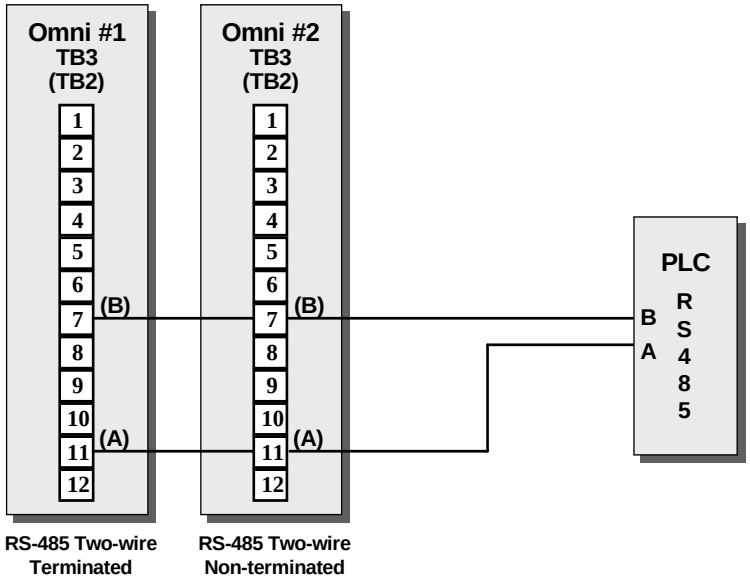


Figure 4. OMNI 6000 (3000) Peer-to-Peer Wiring Requirements with PLC using the RS-485 Two-wire Multi drop

Setting up Transactions

NOTE: Modbus Broadcast Address '0' – this address only applies to write transactions.

To process a transaction the flow computer requires the following data for each transaction:

Slave ID: The Modbus address of the target device. This can be any valid Modbus address including the broadcast address '0'.

Read or Write: Select the appropriate operation.

Source Point Number: Specifies the data base address of the variable in the source device. For a read operation the slave is the source. For a write operation the source is the OMNI flow computer master.

Number of Points: The number of consecutive data variables to transfer between devices, starting at the source point number or address.

Destination Point Number: Specifies the data base address of the variable in the destination device. For a write operation the slave is the destination. For a read operation the destination is the OMNI flow computer master.

What Modbus Function Codes Are Used

The flow computer determines what Modbus function code will be used depending upon the OMNI flow computer data type specified in the transaction. Transactions involving short or long integers or IEEE floats will use Modbus function codes 03_H for reads and 10_H for writes. Boolean variables are packed 8 to a byte starting at LS bit and use function codes 01_H for reads and $0F_H$ for writes.

Special Considerations when 'Modicon Compatible' is Selected for Port #2

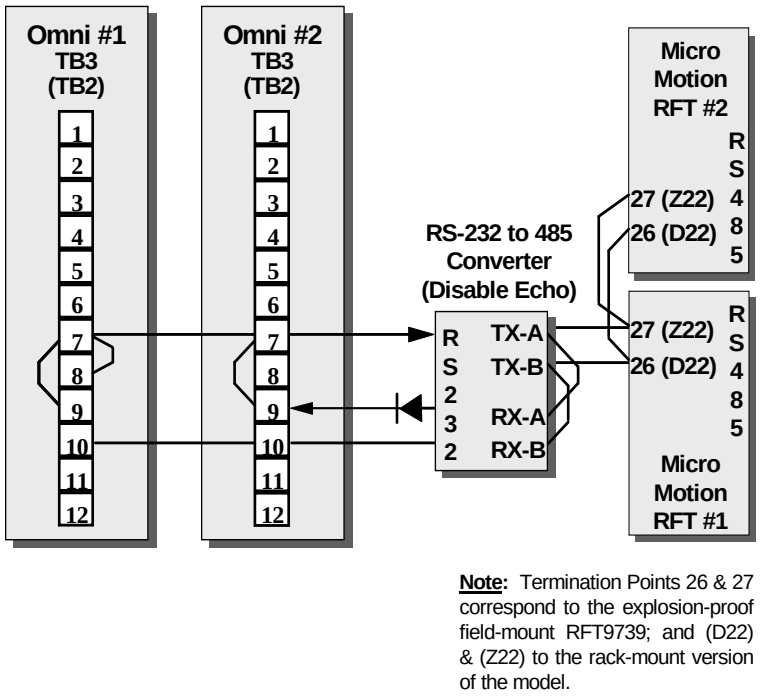
Some adjustments to the previous entries are needed when communicating with devices that require 'Modicon Compatible' to be selected for the peer-to-peer port.

1. All data base point addresses (whether source or destination) referring to the foreign Modicon compatible device, should be entered as one less than the point address listed. This is needed because the Modicon device automatically adds one to the address received over the data link and subtracts one from the address before transmitting. References to data base point addresses within the OMNI Flow Computer master still use the normal point address as shown in the OMNI documentation.
2. The number of points entry becomes the number of 16 bit registers to transfer, rather than the number of data variables.

Using Peer-to-Peer with Micro Motion™ Coriolis Mass Meters

The OMNI Flow Computer can be configured to accept mass or volume pulses from a Micro Motion (MM) Coriolis Meter RFT transmitter as well as communicate via Modbus to the device and obtain variables such as fluid density and MM transducer alarm status.

The flow computer is equipped with special firmware to make the interface to the Micro Motion meter more useful and simpler. The communication link between the Micro Motion meter and the flow computer is via the peer-to-peer link. It is possible to have multiple Micro Motion meters connected to multiple flow computers as shown in Figure 5.



Note: Termination Points 26 & 27 correspond to the explosion-proof field-mount RFT9739; and (D22) & (Z22) to the rack-mount version of the model.

Figure 5. OMNI 6000 (3000) Peer-to-Peer Wiring Requirements with Micro Motion RFT Transmitters using a RS-232 to RS-485 Converter

Figure 6 shows a typical peer-to-peer installation using RS-485, where two flow computers are connected to two Micro Motion RFT9739 transmitters via a proprietary RS-232/485 Serial I/O Module #68-6205.

NOTE: Micro Motion Elite® Model RFT9739 Transmitter Connectivity – Both field-mount (explosion-proof) and rack-mount models of the RFT9739 transmitter have the A and B channels reversed to the industry standard applied to OMNI Flow Computers; i.e., the flow computer's A channel connects to Micro Motion's B channel. OMNI has tested this connectivity with the Micro Motion RFT9739 Field-Mount Transmitter, but connecting to the rack-mount version has not yet been tested. Information on this connectivity has been provided by Micro Motion, Inc. Please contact Micro Motion for further information.

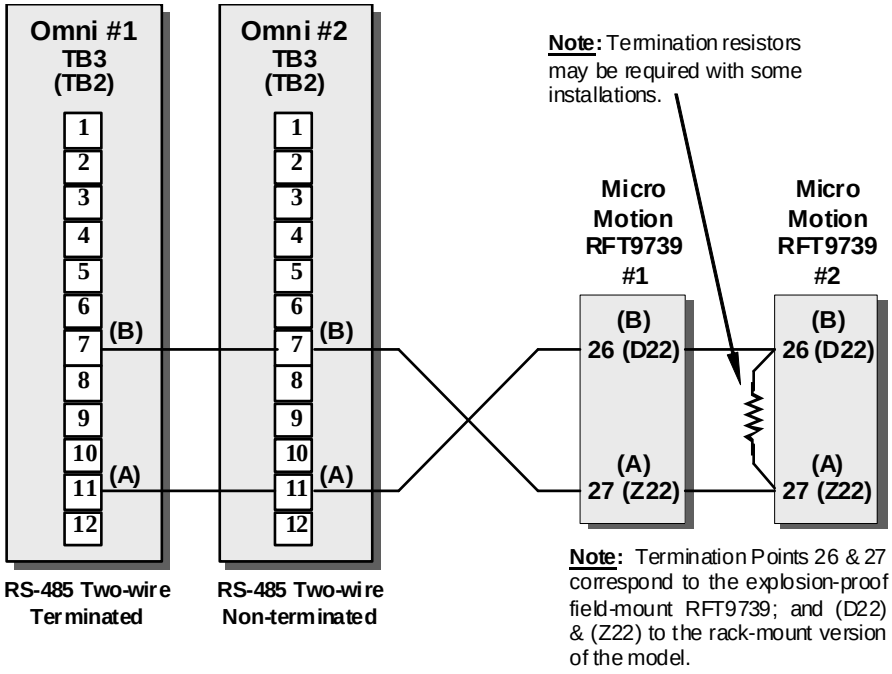


Figure 6. OMNI 6000 (3000) Peer-to-Peer Wiring Requirements with Micro Motion RFT9739 Transmitters using the RS-485 Two-wire Multi-drop

The Micro Motion Meter is a Modicon Compatible Device

Some adjustments to the peer-to-peer entries are needed when communicating with devices that require '*Modicon Compatible'* to be selected for the peer-to-peer port (Serial Port #2).

1. All data base point addresses (whether source or destination) referring to the foreign Modicon compatible device, should be entered as one less than the point address listed. This is needed because the Modicon device automatically adds one to the address received over the data link and subtracts one from the address before transmitting. References to data base point addresses within the OMNI flow computer master still use the normal point address as shown in the OMNI documentation.
2. The *number of points* entry becomes the number of 16 bit registers to transfer, rather than the number of data variables.

Setting Up the Peer-to-Peer Transactions

NOTE: Meter Run #1 Density I/O point must be assigned to '99' and Serial Port #2 must be assigned to be 'Modicon Compatible' for this to work correctly. Note also that the MM Modicon documentation manual lists the flowing density as point number 20249..This is common with Modicon compatible devices. Where there is a 5 digit address, drop the first digit and subtract 1 from the point address before using it in a transaction.

The following peer-to-peer transaction reads the flowing density of the fluid from the Micro Motion device (Modbus ID #2) and stores it in data base point 7108 (unfactored density, meter run #1).

Transaction #1	Target Slave ID	…….	2
	Read/Write?	…….	R
	Source Point #	…….	248
	# of Points	…….	2
	Destination Pnt #	…….	7108

The next transaction reads a 16-bit integer register from the MM meter which contains packed alarm status bits. These are stored in a special register within the flow computer which causes them to be time and date tagged, printed and logged just as though they were flow computer alarms.

Transaction #2	Target Slave ID	…….	2
	Read/Write?	…….	R
	Source Point #	…….	0
	# of Points	…….	1
	Destination Pnt #	…….	3118

The examples above refer to Meter #1 transactions that the flow computer is requesting. More transactions may be needed depending upon what data is required and how many meter runs are being used

DOCUMENT REVISION HISTORY

DOCUMENT INITIAL RELEASE DATE.....**22-May-2003**

REVISION	DATE	PURPOSE / CHANGE REQUEST
A	22-May-2003	Maintained on the web - Initial release
B	09-April-2009	DCR 090109