

# 2573-MOD Serial Interface Adapter to Power Measurement 3300-ACM Digital Power Meter

The CTI 2573-MOD Serial Interface Adapter acts as a Modbus Master and allows the Simatic 505 PLC to access data from one or more 3300 ACM Power Meters on a RS-485 network.

The purpose of this application note is to provide a specific example of how to interface the 2573-MOD to the 3300 ACM Digital Power Meter using Modbus RTU protocol. The user should first have read the CTI 2573-MOD Serial Device Interface Adapter Installation & Operation Guide, the 3300 ACM Installation & Operation Manual, and the 3300 ACM / Modicon Modbus Serial Communications Protocol Manual.

## MODULE DIP SWITCH SETTINGS

(Ref. CTI 2573-MOD Installation & Operation Guide Chapter 2. Installation)

The DIP switch block corresponding to Port No. 3 must be set for PLC Select to allow Modbus RTU protocol to be initiated by ladder logic using the Create Connection Command Block. Setting DIP switches 6, 7, and 8 to the ON position selects PLC Select mode. All other switches on the switch block should be set to the OFF position.

## PLC COMMAND INTERFACE

(Ref. CTI 2573-MOD Installation & Operation Guide, Appendix D. PLC Command Interface)  
In this example, the 2573-MOD is assumed to be logged into the 505 base in Slot No. 1. The 2573-MOD logs into the CPU memory as a Special Function 2WX, 6WY module. The following addresses are assigned to the 2573-MOD: WX1, WX2, WY3, WY4, WY5, WY6, WY7, and WY8 (assuming the module starts at WX1). PLC ladder logic controls the 2573-MOD by placing pointers in WY registers which point to tables stored in V-memory. Command triggers are controlled via RLL to "wake up" the 2573-MOD and capture the instructions from V-memory. Areas of V-memory called Command Blocks are used to store the command parameters.

## LADDER LOGIC

(Ref. CTI 2573-MOD Installation & Operation Guide Chapter 7. PLC Logic - Modbus RTU Master Example)

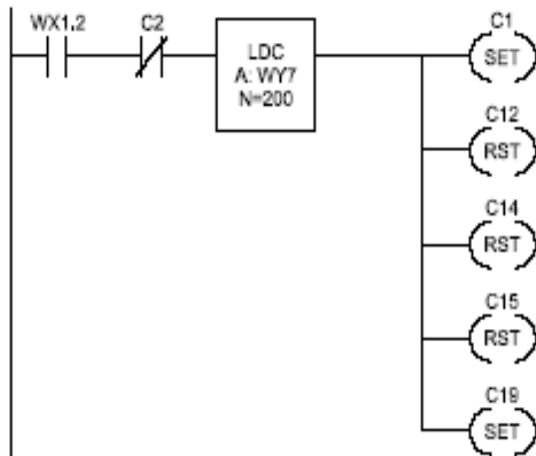
The ladder logic example, used in relationship with V-memory Command Blocks, creates a connection (V200) to Port No. 3 of the 2573-MOD on first power up. Then a Modbus Query Command (V220) is executed on each completion of a command cycle. Command errors are monitored at V200 and V220 of the respective command blocks. If an error occurs during the execution of the Create Connection Command or the Query Command, the error code word is moved to V401 and V402 respectively for examination. The error is acknowledged by setting the Error Acknowledge bit in WY4 for the appropriate command slot and another command cycle begins.



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This rung selects the Create Connection Command Block by loading the V memory address of 200 in WY7. The 2573-MOD will turn the WX1.2 (SER CFG) bit on when the module is reset; it will remain on until all ports have been configured (either by DIP switch or by a Create Connection). Thus this rung is executed when WX1.2 first goes high.

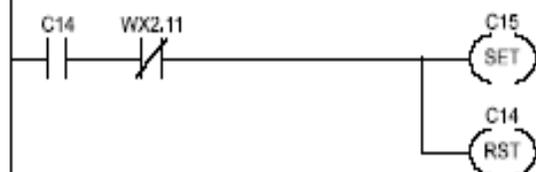
C1 is set high to indicate that WY7 points to the Create Connection Command. C14 and C15 are reset to indicate no command cycle is in progress. The trigger enabling relay (C19) is turned on so the command trigger will fire.



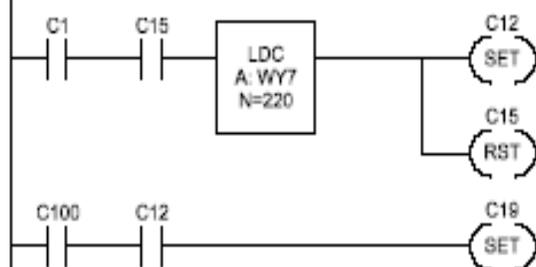
When WX1.2 is on, C2 is turned on. This prevents the previous rung from re-executing on subsequent scans.



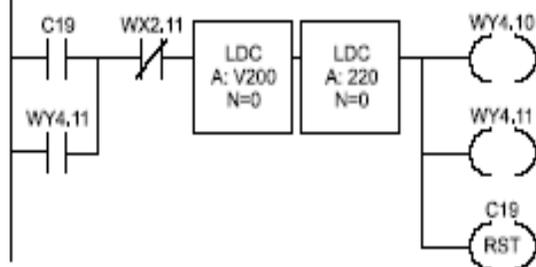
C14 is used as a flag which indicates that the command cycle was started. The cycle starts when Command Busy (WX2.11) comes on. C15 is reset at the beginning of a command cycle.



Once the command cycle is started (C14 is on), when command busy goes off, the command cycle is complete. The Cycle Complete flag (C15) is set and C14 is reset.

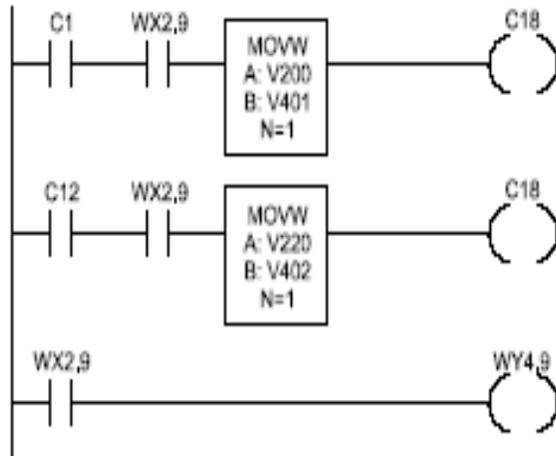


If C1 is on, then WY7 contains the address of the Create Connection Command Block. When C15 is on, the module has completed a command cycle. When both events are true, you have successfully created a connection and are ready for the Send Query Command. This rung loads WY7 with the address of this Command Block (V220), sets C12 to indicate this, and resets the Cycle Complete flag (C15).



This rung is used to enable the trigger for the Send Query command, assuming that other logic sets C100 when a particular event happens.

This rung is the command trigger for coupled mode. The Command Error words in both command blocks are cleared each time a new command cycle is initiated.



If an error occurs (WX2.9 is on) and the Create Connection command is executing (C1 is on), this copies the Command Error Word to another V memory location.

This rung performs a function similar to the rung above for errors that occur when executing the Send Query command (C12 is on).

This rung raises ERRACK (WY4.9) when the command error (WX2.9) is raised. When the error is acknowledged, the 2573 will lower command busy and command error. You can then trigger a new command.

### CREATE CONNECTION COMMAND (V200 - V215)

(Ref. CTI 2573-MOD Serial Interface Adapter Installation & Operation Guide, Chapter 5, Modbus Master.)

The Create Connection Command starts the Modbus RTU protocol manager and creates a physical connection to Port No. 3 of the 2573-MOD. The connection number assigned here (19223) to Port No. 3 will be used in subsequent commands to identify the module port to be associated with the command. The communication parameters are set up for the port. These are set to match the communication parameters of the 3300 ACM communication port. These parameters are: 9600 baud, no parity, and RS-485 communication.

The Create Connection Command only needs to be executed one time per port. The only times the Create Connection Command would need to be executed again would be to start a new protocol manager, change communication parameters, or change connection numbers. If the Create Connection Command is triggered more than once, an error code will be written to the Command Error Word (offset 0) of the Create Connection Command block. To close a connection that was previously created by a create connection command, a close connection command must be initiated (Ref. CTI 2573-MOD Serial Device Interface Adapter Installation & Operation Guide, Chapter 5) or power cycled to 2573-MOD.

#### CREATE CONNECTION COMMAND BLOCK

V-Memory Location	Description	Hex Value	Integer Value	Comments
V200	Command Error Word	0000	00000	An error code will be written here if one is encountered when the command is executed
V201	Command (Create Connection)	0001	00001	Command code for 'create connection'
V202	Connection Number = 19223		4B17	19223
V203	Protocol Manager Number (Modbus Master RTU)	002B	00040	Valid values are 19221 - 19299 Select Modbus RTU Protocol
V204	Physical Port Number = 3	0003	00003	Port number 3 of 2573-MOD
V205	Port Baud Rate = 9600	2580	09600	Match baud rate of the 3300 ACM
V206	Reserved (Set to zero)	0000	00000	This word is not used
V207	Parity (0 = None, 1 = Odd, 2 = Even)	0000	00000	Select NO parity to match port set up of 3300 ACM
V208	Reserved (Set to zero)	0000	00000	This word is not used
V209	Handshake (0 = none, 4 = RS-485)	0004	00004	Select RS-485 communication
V210-V215	Unused - reserved for future use (Set to 0)	0000	00000	These locations should be set to 0 and not used by another application

### SEND QUERY COMMAND

(Ref. CTI 2573-MOD Serial Interface Adapter Installation & Operation Guide, Chapter 5.)

In the Modbus protocol, the master device (2573-MOD) initiates a transaction (called a query) to the slave device (3300 ACM). The following command block shows how to set up the query command to read 16 holding registers from the 3300 ACM beginning at address 40011. The Modbus Master Protocol Manager will build the query message based on the data you supply in the Send Query Command Block for the address, function, and data fields. The Modbus Master Protocol Manager will calculate the CRC characters and ensure that the message framing timing requirements are met.

## SEND MODBUS QUERY COMMAND BLOCK

V-Memory Location	Description	Hex Value	Integer Value	Comments
V220	Error Word	0000	00000	An error code will be written here if an error is encountered when the command is executed
V221	Command Code (Modbus Send)	2801	10241	Command code for 'send Modbus query'
V222	Connection Number		4817 19223	Matches connection for port 3 in create connection command block
V223	Command Flag	0000	00000	Not used in this version
V224	Modbus Slave Address	0001	00001	The 3300 ACM in this example is set to address 1
V225	Modbus Function Code	0003	00003	Read Holding Registers
V226	Query Data V-Memory Location	00F0	00240	Query Data is stored in V-memory starting at V240
V227	Query Data Length	0004	00004	There are 2 words (4 bytes) of data. This should exactly match the number of bytes used in the query data stored at V240.
V228	Response V-Memory Location	00FA	00250	This is the V-memory location within the 505 PLC where the response from the 3300 ACM is to be stored
V229	Response V-Memory to reserve	0032	00050	Reserve 50 bytes (25 words) for the response. You must make sure that you reserve enough memory to accommodate the number of registers that you ask for, plus 4 bytes for the response function code and byte count. You can reserve more than you need for the actual response.
V230	Command Time-Out		0002 00002	Sets command time-out for 2 seconds. If time-out errors are encountered, this may be increased. A value of 0 will default the time-out at 9 seconds.
V231-V235	Unused (set to 0)	0000	00000	These locations should be set to 0 and not used by another application.

## QUERY DATA

The query data portion of the Modbus request in this example is stored at V-memory location 240 and contains the starting register address and the number of registers to read. In this example, we are reading the 3300 ACM standard registers beginning at address 40011.

According to the Modbus protocol, in response to a request for register 4xxxx of a particular slave device (3300 ACM), the Modbus master (2573-MOD) reads register xxxx-1 from the slave (3300 ACM). For example, register address 40011 corresponds to register #10 in the 3300 ACM (Ref. 3300 ACM Modbus Protocol Manual).

V-Memory Location	Hex Value	Integer Value	Comments
V240	000A	00010	Starting Address
V241	0010	00016	Number of Registers

## QUERY RESPONSE

In this example, the response from the 3300 ACM is stored in the 505 PLC beginning at V-memory location 250. The first 4 bytes (2 words) will contain the response function code and the byte count (number of bytes returned). This is followed by the actual data values read from the holding registers addressed in the query message.

V-Memory Location	Hex Value	Integer Value	Comments
V250	0003	00003	Response Function Code
V251	0020	00032	Byte Count (16 words = 32 bytes)

V-Memory Location	3300 ACM Register Address	Example Data (Hex)	Example Data (Integer)
V252	40011 Register #10 (Vbn)	0168	00360
V253	40012 Register #11 (Vbn)	0168	00360
V254	40013 Register #12 (Vbn)	0168	00360
V255	40014 Register #13 (Vln average)	0168	00360
V256	40015 Register #14 (Vab)	0270	00624
V257	40016 Register #15 (Vbc)	0270	00624
V258	40017 Register #16 (Vca)	0270	00624
V259	40018 Register #17 (Vll average)	0270	00624
V260	40021 Register #18 (Ia)	13BA	05050
V261	40022 Register #19 (Ib)	13BA	05050
V262	40023 Register #20 (Ic)	13BA	05050
V263	40024 Register #21 (Iaverage)	13BA	05050
V264	40034 Register #22 (KW Total)	1389	05001
V265	40050 Register #23 (Realtime Polarity Register)	0004	00004
V266	40055 Register #24 (KWH Total)	2735	10037
V267	40056 Register #25 (M/GWH Total)	0001	00001