Application Note 007
Version 002
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Configuring EtherMeter® – Koyo DL06 Communications Using MODBUS®/TCP or MODBUS®/RTU.

(Note: This document or portions thereof may also apply to other DL Series PLC's from Koyo / Automation Direct.)

The purpose of this document is to provide assistance to the Koyo PLC user who wishes to connect to an EtherMeter using the MODBUS/TCP or MODBUS/RTU protocol. This document assumes that the user is well-versed in Koyo PLC's and the DirectSOFT Programming Environment.

To simplify integration into a MODBUS/TCP or MODBUS/RTU network, the EtherMeter implements MODBUS according to the published Modicon standard without proprietary extensions.

In practical DL06 applications, generally MODBUS/TCP or MODBUS/RTU would be used. However, for demonstration purposes, this application note presents a DL06 PLC that utilizes concurrent MODBUS/TCP and MODBUS/RTU connections to an EtherMeter.

MODBUS/TCP:

When creating a MODBUS/TCP client/server connection between a Koyo PLC (client) and an EtherMeter™ (server), no special setup is generally required within the EtherMeter's Setup Menu. The EtherMeter features an "always-on" MODBUS/TCP server on TCP logical port 502; and it is configured to auto-detect and service incoming client requests from Modbus-compatible PLC's.

MODBUS/RTU:

When creating a MODBUS/RTU master/slave connection between a Koyo PLC (master) and an EtherMeter™ (slave), no special setup is generally required within the EtherMeter's Setup Menu. The EtherMeter's default serial protocol is MODBUS/RTU and its default slave ID is "4". Port Parameters default to 9600/8/N/1. Depending upon DIP-switch settings, the serial connection may be via RS-232 or RS-485.

EQUIPMENT & SOFTWARE USED IN THIS APPLICATION:

In this sample application, the Koyo PLC used was a Model DL06 (Part No. D0-06DR-D), equipped with an Ethernet/MODBUS Communication Module (Part No. H0-ECOM100), Serial/MODBUS Communication Module (Part No. D0-DCM), an LCD Display Module (Part No. D0-06LCD), and an Analog I/O Module (un-used in this application, Part No. F0-4AD2DA-1).

The PLC programming software used for this project was DirectSOFT5 (Vers. 5.2), and the ECOM100 Ethernet Module setup software was NetEdit 3 (Vers. 3.7c).

1. Ethernet Wiring Configuration.

    In this example, the Ethernet ports of the DL06 and EtherMeter are wired directly to each other, without an Ethernet switch, using a single Ethernet cable and crossover adapter. See Figure 4. Alternatively, the Ethernet ports of both the DL06 and EtherMeter could be connected to a common Ethernet switch if expanded network connectivity is desired. See Figure 5.

2. Serial Wiring Configuration.

In this example, RS-232 serial connectivity was implemented. Port 2 of the D0-DCM was connected directly to the RS-232 Serial Port of the EtherMeter. A custom cable was created, per the pinout specifications of the DO-DCM and the EtherMeter.

If you also wish to build your own cable, then the following materials and procedures are recommended:

Materials:

a. Solder Cup D-Sub Connector. HD15 Male.
    L-COM P/N SDH15P
b. Assembled D-Sub Hood Kit, DB9/HD15
    L-COM P/N SDC9B
c. Ethernet Patch Cable (Must be wired as 568-B)

Procedures:

a. Cut one of the ends off the Ethernet Patch Cable, and strip back 1" of the jacket.
b. Make the solder connections as detailed in Figure 1 and Figure 2.
c. Attach the D-Sub Hood Kit to complete the cable. See Figure 3.

1:	6:	11:
2: BLUE/WHITE	7: BLUE	12:
3: GREEN	8:	13:
4: --> Short to 5	9:	14:
5: --> Short to 4	10:	15:

Figure 1. HD15-Patch Cable Solder Connections.

Figure 2. HD15-Patch Cable Solder Connections.

Figure 3. Completed EtherMeter-D0-DCM Cable.

NOTE:

If the user desires to purchase/use factory-built cable assemblies, then the following three parts can be mated together to produce the desired HD15M-RJ45 cable:

Koyo   D2-DSCBL-1 (DB9F-HD15M Cable)
SCADAmetrics   EM-ADAPT-DTE (DB9M-RJ45)
Ethernet Patch Cable   -any-

3.   EtherMeter Configuration.

   The EtherMeter was configured with the following setup commands:
   SET   EXP1   -1
   SET   EXP2   -1
   SET   END32   LITTLE
   SET   FMTFLOW   FLOAT
   SET   BANNER   KOYO_DL06_PLC__MODBUS_DEMO

4.   Meter Registers.

   The connected meters are Sensus "ICE" encoder-type registers. Both were pre-programmed to transmit eight (8) totalization digits.

Figure 4. Koyo MODBUS Communication Demonstration Panel.
DL06 PLC / EtherMeter Hardware and Wiring Configuration.

Notes:

1. The DL06 and EtherMeter are both powered by a single AC/DC Converter (24VDC output).
2. The DL06 is equipped with:
    a. LCD Display Module (D0-06LCD).
    b. Ethernet/ModbusTCP Module (H0-ECOM100).
    c. Serial/MODBUS Module (Part No. D0-DCM).
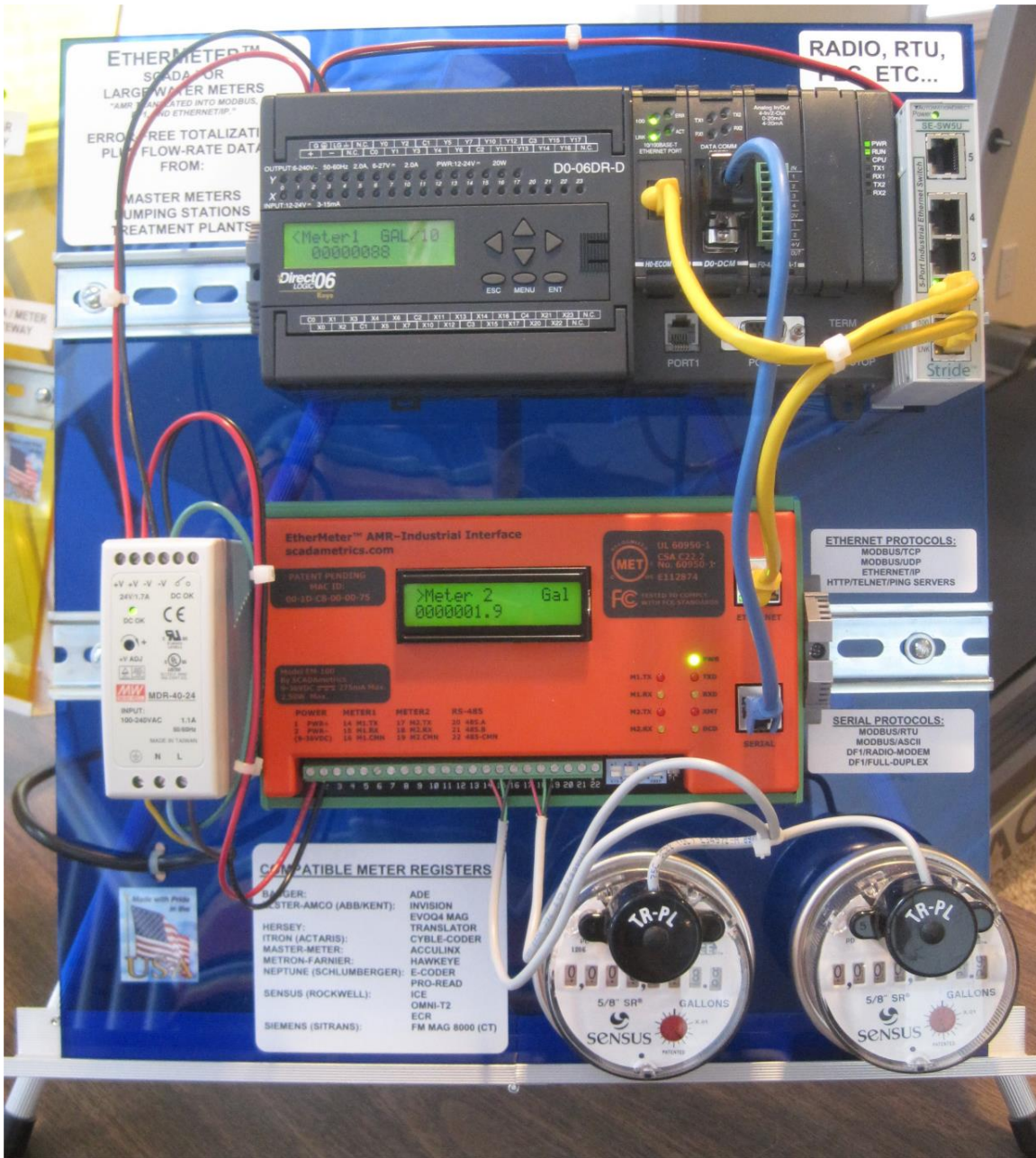   d. Analog I/O Module (un-used in this application, Part No. F0-4AD2DA-1).

**Figure 5. Alternate Koyo MODBUS Communication Demonstration Panel.
DL06 PLC / EtherMeter / Switch Hardware and Wiring Configuration.**

Notes:

3. **The DL06, EtherMeter, and Switch are powered by a single AC/DC Converter (24VDC output).**
4. **The DL06 is equipped with:**
    e. **LCD Display Module (D0-06LCD).**
    f. **Ethernet/ModbusTCP Module (H0-ECOM100).**
    g. **Serial/MODBUS Module (Part No. D0-DCM).**
    h. **Analog I/O Module (un-used in this application, Part No. F0-4AD2DA-1).**
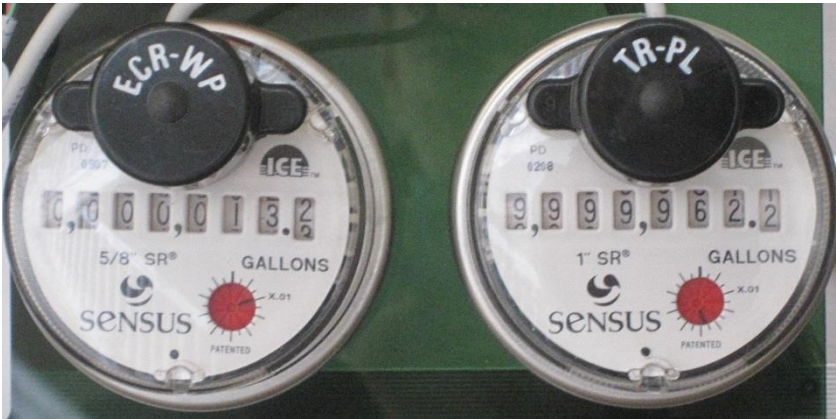
Figure 6. Closeup of the two Sensus "ICE" Meter Registers.

5. HO-ECOM100 Ethernet Module Initial Configuration.

Initially, both the EtherMeter and the DL06 were powered up and both were connected to an office LAN network with 192.168.1.nnn addressing. The EtherMeter defaults to a static IP address of 192.168.1.140, and this address was not modified. The DL06 defaults to an automatically-obtained IP address using DHCP.

A configuration workstation was connected to the LAN, and which contained NetEdit 3 and DirectSOFT software.

NetEdit 3 was started and and "Scan Network" command was used to locate the IP address of the DL06 and to configure the ECOM100 module. (See Figure 7.)
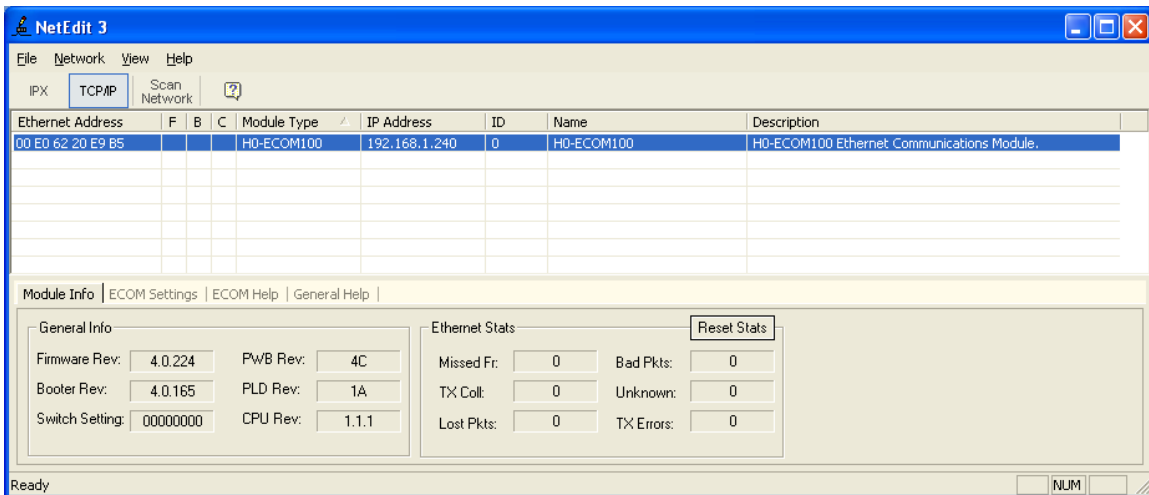

Figure 7. NetEdit 3 Network Scan Display.

Using NetEdit3 and within the "ECOM Settings>General" submenu, static IP addressing and valid network addresses were specified. (See Figure 8.)

Module ID: 0
IP Address: 192.168.1.240 (static)
Subnet Mask: 255.255.255.0
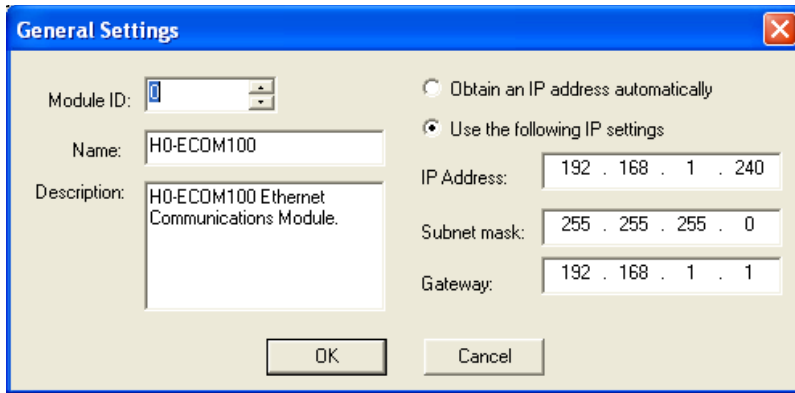Gateway: 192.168.1.1

Figure 8. NetEdit 3: General Settings Menu.

6. HO-ECOM100 Ethernet Module Peer-to-Peer Configuration.

Using NetEdit3 and within the "ECOM Settings>Peer-to-Peer Config" submenu, the EtherMeter's MODBUS/TCP server properties were specified. (See Figure 9.)

RW/WX Device Number: 1
MODBUS/TCP
IP Address: 192.168.1.140
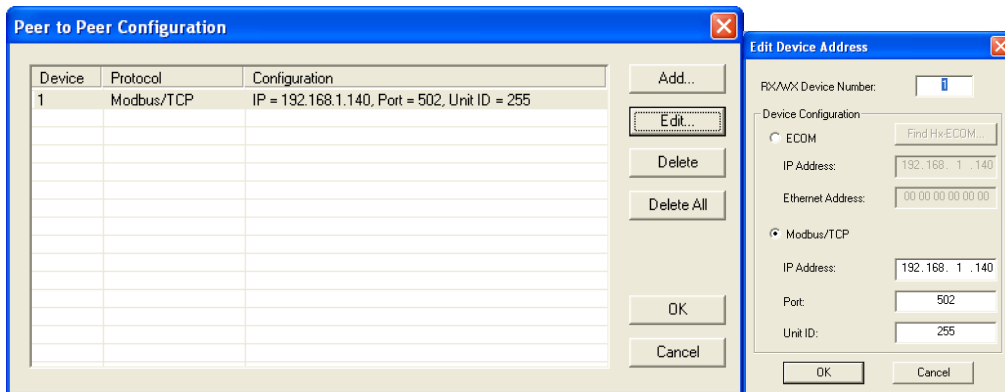Port: 502
Unid ID: 255

Figure 9. Ethernet Port Configuration Dialog Boxes

7. Ladder Logic.

In this example, ladder logic was created using the DirectSOFT PLC programming software. (See Figure 10.)
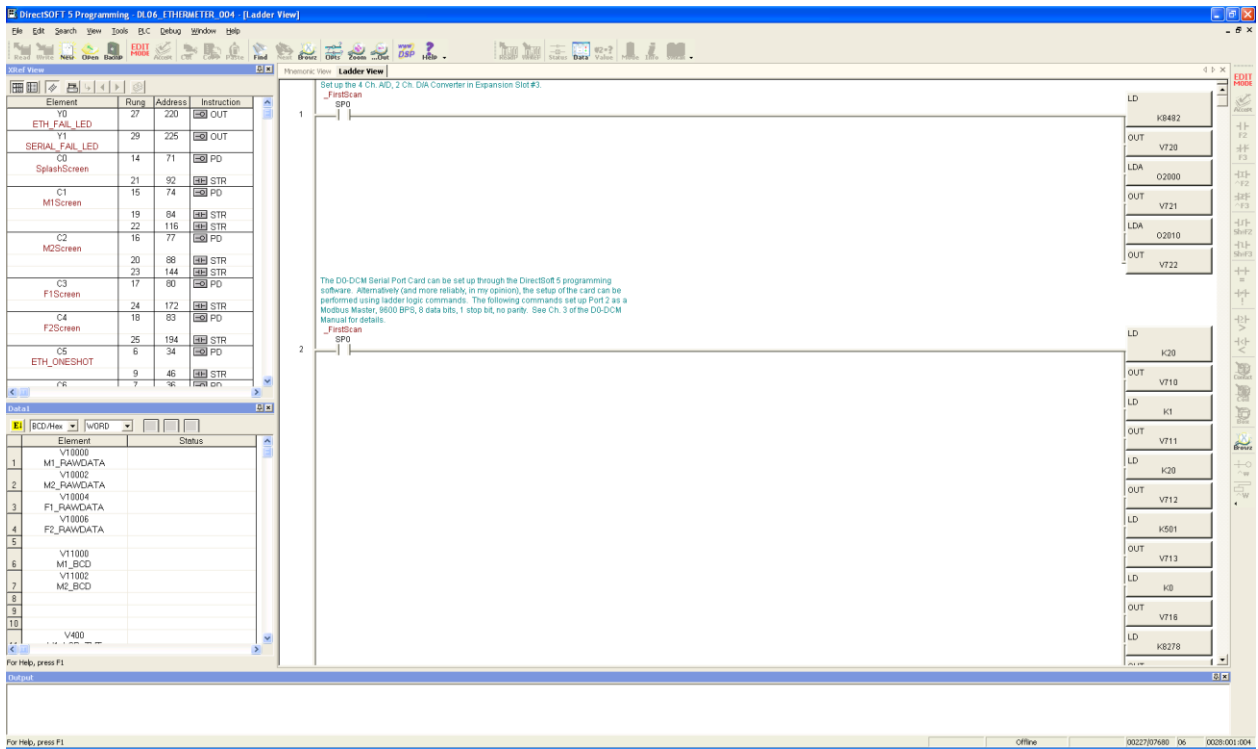

Figure 10. DirectSOFT 5 PLC Programming Environment.

In this example, logic was entered that performs the following tasks:

a. Polls the EtherMeter for data using the MODBUS/TCP protocol at 500 msec intervals and the MODBUS/RTU protocol at 500 msec intervals. In practice, a shorter or longer polling interval could be selected, depending upon the application.

b. Displays the data on the DL06's LCD Display module.

The complete ladder logic program, including descriptive comments, is appended to this document.