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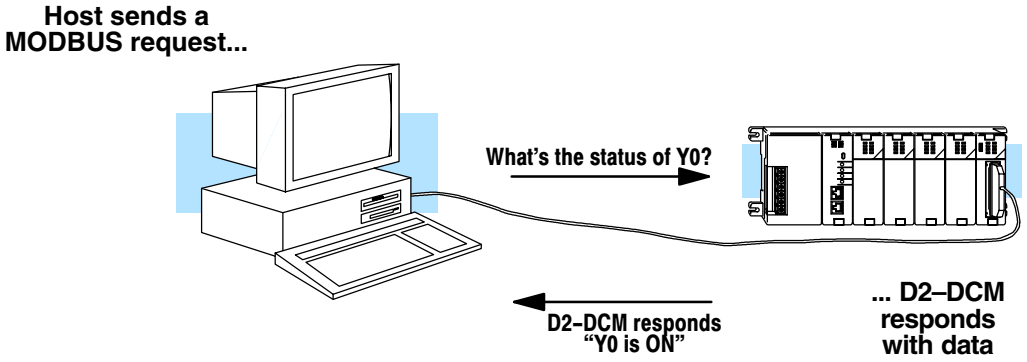
Using the D2–DCM with MODBUS

Introduction

How Does the D2–DCM work with MODBUS?

The D2–DCM can be used as a slave interface to a network using the MODBUS RTU protocol. To use the D2–DCM with MODBUS, your host software must send a MODBUS function code and a MODBUS address to specify a PLC memory location that is understood by the D2–DCM.



It would be quite difficult to discuss all of the ins and outs of MODBUS in this document. Instead, the purpose of this Appendix is to:

- provide a quick overview of MODBUS Data Types and Function Codes.
- how to determine the proper MODBUS address necessary to allow the host software to access various memory locations in the DL205 system.

One key point to remember is that not all host software packages using MODBUS drivers operate exactly the same way. That is, there are a couple of different ways to achieve the same result, especially when it comes to specifying the needed address for the PLC memory location. *Therefore, it is important that you follow the instructions for your particular software package or network master.*

MODBUS Function Codes Supported

The host software package reads or writes information by sending a MODBUS function code to the D2–DCM. The following table provides a description of the MODBUS function codes supported by the D2–DCM.

MODBUS Code	Function	DL205 Data Types Available
01	Read a group of coils	Y, CR, T, CT
02	Read a group of inputs	X, SP
05	Set / Reset a single coil	Y, CR, T, CT
15	Set / Reset a group of coils	Y, CR, T, CT
03, 04	Read a value from one or more registers	V
06	Write a value into a single register	V
16	Write a value into a group of registers	V

NOTE: The maximum MODBUS secondary address supported by the D2–DCM is 60 (5A hex).

MODBUS Data Types Supported

You are probably accustomed to seeing data types like X input, Y output, C control relay, V memory data registers, etc. for the various types of memory in a DL205 system. For example, if you need to know the status of Y12, then you ask for Y12. MODBUS does not use these same data types, so you have to determine which MODBUS data type corresponds to the PLC memory location that you need. The following table will help.

DL205 Memory Type	Quantity[1] (Decimal)	PLC Range (Octal)	Corresponding MODBUS Data Type
Inputs (X)	320	X0 – X477	Input
Special Relays (SP)	144	SP0 – SP137 SP540 – SP617	Input
Outputs (Y)	320	Y0 – Y477	Coil
Control Relays (CR)	256	C0 – C377	Coil
Timer Contacts (T)	128	T0 – T177	Coil
Counter Contacts (CT)	128	CT0 – CT177	Coil
Stage Status Bits (S)	512	S0 – S777	Coil
Timer Current Values (V)	128	V0 – V177	Input Register
Counter Current Value (V)	128	V1000 – V1177	Input Register
V Memory, user data (V)	1024	V2000 – V3777	Holding Register
V Memory, user data (V) Non–volatile	256	V4000 – V4377	Holding Register
V Memory, system (V)	106	V7620 – V7737 V7746 – V7777	Holding Register

Determining the MODBUS Address

There are typically two ways that most host software packages allow you to specify a PLC memory location. These are:

- By specifying the MODBUS data type and address.
- By specifying a MODBUS address only.

If the Host Software Requires the Data Type and Address...

Many host software packages allow you to specify the MODBUS data type and the MODBUS address that corresponds to the PLC memory location. This is the easiest method, but not all packages allow you to do it this way. The various MODBUS data types were presented earlier, but they have been included again in the following table.

The actual equation used to calculate the address depends on the type of PLC data you are using. The PLC memory types are split into two categories for this purpose.

- Discrete – X, SP, Y, CR, S, T (contacts), C (contacts)
- Word – V, Timer current value, Counter current value

In either case, you basically convert the PLC octal address to decimal and add the appropriate MODBUS address (if required). The following tables show the exact equation used for each group of data.

DL205 Memory Type	QTY[1] (Dec.)	PLC Range (Octal)	MODBUS Address Range	MODBUS Data Type
For Discrete Data Types .... Convert PLC Addr. to Dec. + Start of Range + Data Type				
Inputs (X)	320	X0 – X477	2048 – 2367	Input
Special Relays (SP)	144	SP0 – SP137 SP540 – SP617	3072 – 3167 3280 – 3471	Input
Outputs (Y)	320	Y0 – Y477	2048 – 2367	Coil
Control Relays (CR)	256	C0 – C377	3072 – 3551	Coil
Timer Contacts (T)	128	T0 – T177	6144 – 6271	Coil
Counter Contacts (CT)	128	CT0 – CT177	6400 – 6527	Coil
Stage Status Bits (S)	512	S0 – S777	5120 – 5631	Coil
For Word Data Types .... Convert PLC Addr. to Dec. + Data Type				
Timer Current Values (V)	128	V0 – V177	0 – 127	Input Register
Counter Current Values (V)	128	V1000 – V1177	512 – 639	Input Register
V Memory, user data (V)	1024	V2000 – V3777	1024 – 2047	Holding Register
V Memory, user data (V) non–volatile	256	V4000 – V4377	2048 – 2303	Holding Register
V Memory, system (V)	106	V7620 – V7737 V7746 – V7777	3984 – 4063 4070 – 4095	Holding Register

DL250–1 Memory Type	QTY[1] (Dec.)	PLC Range (Octal)	MODBUS Address Range	MODBUS Data Type
For Discrete Data Types .... Convert PLC Addr. to Dec. +			**Start of Range +**	**Data Type**
Inputs (X)	512	X0 – X777	2048 – 2560	Input
Special Relays (SP)	512	SP0 – SP137 SP320 – SP717	3072 – 3167 3280 – 3535	Input
Outputs (Y)	512	Y0 – Y777	2048 – 2560	Coil
Control Relays (CR)	1024	C0 – C1777	3072 – 4095	Coil
Timer Contacts (T)	256	T0 – T377	6144 – 6399	Coil
Counter Contacts (CT)	128	CT0 – CT177	6400 – 6527	Coil
Stage Status Bits (S)	1024	S0 – S1777	5120 – 6143	Coil
For Word Data Types .... Convert PLC Addr. to Dec.			**+**	**Data Type**
Timer Current Values (V)	256	V0 – V377	0 – 255	Input Register
Counter Current Values (V)	128	V1000 – V1177	512 – 639	Input Register
V Memory, user data (V)	3072 4096	V1400 – V7377 V10000 – V17777	768 – 3839 4096 – 8192	Holding Register
V Memory, system (V)	320	V700 – V777 V7400 – V7777	448 – 768 3840 – 3735	Holding Register

Example 1: V2100

Find the MODBUS address for User V location V2100.

1. Find V memory in the table.
2. Convert V2100 into decimal (1089).
3. Use the MODBUS data type from the table.

PLC Address (Dec.) + Data Type

V2100 = 1088 decimal

1088 + Hold. Reg. = **Holding Reg. 1089**

Timer Current Values (V)	128	V0 – V177	0 – 127	Input Register
Counter Current Values (V)	128	V1000 – V1177	512 – 639	Input Register
V Memory, user data (V)	1024	V2000 – V3777	1024 – 2047	Holding Register

Example 2: Y20

Find the MODBUS address for output Y20.

1. Find Y outputs in the table.
2. Convert Y20 into decimal (16).
3. Add the starting address for the range (2049).
4. Use the MODBUS data type from the table.

PLC Addr. (Dec) + Start Addr. + Data Type

Y20 = 16 decimal

16 + 2049 + Coil = **Coil 2065**

Outputs (Y)	320	Y0 – Y477	2049 – 2367	Coil
Control Relays (CR)	256	C0 – C377	3072 – 3551	Coil

Example 3: T10 Current Value

Find the MODBUS address to obtain the current value from Timer T10.

1. Find Timer Current Values in the table.
2. Convert T10 into decimal (8).
3. Use the MODBUS data type from the table.

PLC Address (Dec.) + Data Type

TA10 = 8 decimal

8 + Input Reg. = **Input Reg. 8**

Timer Current Values (V)	128	V0 – V177	0 – 127	Input Register
Counter Current Values (V)	128	V1000 – V1177	512 – 639	Input Register

Example 4: C54

Find the MODBUS address for Control Relay C54.

1. Find Control Relays in the table.
2. Convert C54 into decimal (44).
3. Add the starting address for the range (3072).
4. Use the MODBUS data type from the table.

PLC Addr. (Dec) + Start Addr. +Data Type

C54 = 44 decimal

44 + 3073 + Coil = **Coil 3117**

Outputs (Y)	320	Y0 – Y477	2048 – 2367	Coil
Control Relays (CR)	256	C0 – C377	3073 – 3551	Coil

If the Host Software Requires an Address ONLY

Some host software packages do not allow you to specify the MODBUS data type and address. Instead, you specify an address only. This method requires another step to determine the address, but it is not difficult. Basically, MODBUS also separates the data types by address ranges as well. This means an address alone can actually describe the type of data and location. This is often referred to as "adding the offset". One important thing to remember here is that two different addressing modes may be available in your host software package. These are:

- 484 Mode
- 584/984 Mode

We recommend that you use the 584/984 addressing mode if the host software allows you to choose. This is because the 584/984 mode allows access to a higher number of memory locations within each data type. If your software only supports 484 mode, then there may be some PLC memory locations that will be unavailable. The actual equation used to calculate the address depends on the type of PLC data you are using. The PLC memory types are split into two categories for this purpose.

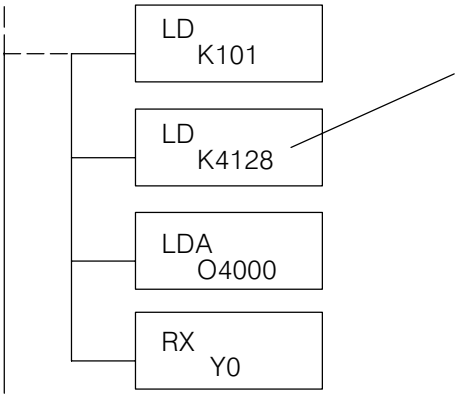
- Discrete – X, GX, SP, Y, CR, S, T, C (contacts)
- Word – V, Timer current value, Counter current value

In either case, you basically convert the PLC octal address to decimal and add the appropriate MODBUS starting address (as required). The following tables show the exact range used for each group of data.

Discrete Data Types				
Memory Type	**PLC Range (Octal)**	**Address (484 Mode)**	**Address (584/984 Mode)**	**Data Type**
Global Inputs (GX)	GX0–GX1746	1001 – 1999	10001–10999	Input
	GX1747 – GX3777	——	11000–12048	Input
Inputs (X)	X0 – X1777	——	12049 – 13072	Input
Special Relays (SP)	SP0– SP777	——	13073 – 13584	Input
Global Outputs (GY)	GY0– GY3777	1 – 2048	1 – 2048	Output
Outputs (Y)	Y0 – Y1777	2049 – 3072	2049 – 3072	Output
Control Relays (CR)	C0 – C3777	3073 – 5120	3073 – 5120	Output
Timer Contacts (T)	T0 – T377	6145 – 6400	6145 – 6400	Output
Counter Contacts (CT)	CT0 – CT377	6401 – 6656	6401 – 6656	Output
Stage Status Bits (S)	S0 – S1777	5121 – 6144	5121 – 6144	Output

Word Data Types			
Registers	**PLC Range (Octal)**	**Input/Holding (484 Mode)***	**Input/Holding (584/984 Mode)***
V Memory (Timers)	V0 – V377	3001/4001	30001/40001
V Memory (Counters)	V1000 – V1177	3513/4513	30513/40513
V Memory (Data Words)	V1200 – V1377	3641/4641	30641/40641
	V1400 – V1746	3769/4769	30769/40769
	V1747 – V1777	——	31000/41000
	V2000 – V7377	——	41025
	V10000 – V17777	——	44097

* MODBUS: Function 04 (New Feature)
The DL05/06, DL250–1/260, DL350 and DL450 will support **function 04** read input register **(Address 30001)**. To use function 04, put the number '4' into the most significant position (4xxx). Four digits must be entered for the instruction to work properly with this mode.



The Maximum constant possible is 4128. This is due to the 128 maximum number of Bytes that the RX/WX instruction can allow. The value of 4 in the most significant position of the word will cause the RX to use function 04 (30001 range).

1. Refer to your PLC user manual for the correct memory mapping size of your PLC. Some of the addresses shown above might not pertain to your particular CPU.

2. For an automated MODBUS/Koyo address conversion utility, download the file **modbus_conversion.xls** from the **www.automationdirect.com** website.

Example 1: V2100 584/984 Mode

Find the MODBUS address for User V location V2100.

1. Find V memory in the table.
2. Convert V2100 into decimal (1088).
3. Add the MODBUS starting address for the mode (40001).

PLC Address (Dec.) + Mode Address

V2100 = 1088 decimal

1088 + 40001 = **41089**

For Word Data Types	PLC Address (Dec.)		+	Appropriate Mode Address		
Timer Current Values (V)	128	V0 – V177	0 – 127	3001	30001	Input Reg
Counter Current Values (V)	128	V1000 – V1177	512 – 639	3001	30001	Input Reg
V Memory, user data (V)	1024	V2000 – V3777	1024 – 2047	4001	40001	Hold Reg.

Example 2: Y20 584/984 Mode

Find the MODBUS address for output Y20.

1. Find Y outputs in the table.
2. Convert Y20 into decimal (16).
3. Add the starting address for the range (2048).
4. Add the MODBUS address for the mode (1).

PLC Addr. (Dec) + Start Address + Mode

Y20 = 16 decimal

16 + 2048 + 1 = **2065**

Outputs (Y)	320	Y0 – Y477	2048 – 2367	1	1	Coil
Control Relays (CR)	256	C0 – C377	3072 – 3551	1	1	Coil
Timer Contacts (T)	128	T0 – T177	6144 – 6271	1	1	Coil

Example 3: T10 Current Value 484 Mode

Find the MODBUS address to obtain the current value from Timer T10.

1. Find Timer Current Values in the table.
2. Convert T10 into decimal (8).
3. Add the MODBUS starting address for the mode (3001).

PLC Address (Dec.) + Mode Address

TA10 = 8 decimal

8 + 3001 = **3009**

For Word Data Types	PLC Address (Dec.)		+	Appropriate Mode Address		
Timer Current Values (V)	128	V0 – V177	0 – 127	3001	30001	Input Reg
Counter Current Values (V)	128	V1000 – V1177	512 – 639	3001	30001	Input Reg
V Memory, user data (V)	1024	V2000 – V3777	1024 – 2047	4001	40001	Hold Reg.

Example 4: C54 584/984 Mode

Find the MODBUS address for Control Relay C54.

1. Find Control Relays in the table.
2. Convert C54 into decimal (44).
3. Add the starting address for the range (3072).
4. Add the MODBUS address for the mode (1).

PLC Addr. (Dec) + Start Address + Mode

C54 = 44 decimal

44 + 3072 + 1 = **3117**

Outputs (Y)	320	Y0 – Y477	2048 – 2367	1	1	Coil
Control Relays (CR)	256	C0 – C377	3072 – 3551	1	1	Coil
Timer Contacts (T)	128	T0 – T177	6144 – 6271	1	1	Coil