

APPLICATION NOTE AN030

Modbus RTU Register Address Mapping

Overview

Unless stated with variances, this document applies to Mega_Link, Mega_Link 2 and the legacy Micro_Link. This Application Note (AN) should be read in conjunction with the relevant manual(s).

Most Mega_Link, Mega_Link 2 and Micro_Link local telemetry and control systems are configured to bring in signals to a centrally located basestation and use hard-wired input/outputs. However, when there are a large number of outstations and associated input signal channels it is often more efficient to use Fieldbus/Modbus over a serial link at the basestation to interface all these system digital and analogue signals into a local PLC and/or SCADA system.

The most popular serial interface protocol is Modbus RTU on serial RS232 or RS485.

In order to program the PLC/SCADA as a Master to control the interfacing of signals, it is necessary to understand the register addresses of individual signals gathered from within the telemetry system.

See Annex #1 for Root Data Block details.

See Annex #2 for Modbus Address diagram.

For complete visualisation of addresses see AN031 Modbus Register Address Listing.

Background

In order to understand the principles of operation of a typical system and the associated signal addressing, this document shows some basic examples, it does not repeat all of the information provided in the relevant manuals.

The basestation maintains and updates a database of the Inputs and Outputs of the system each time it communicates.

A system can comprise of up to 251 data blocks (0...250) Inputs and Outputs.

Data block 0 is the basestation and each block 1-250, corresponds to an outstation address.

Conventionally, outstation units are given addresses 10, 20, 30, 40 etc. to allow space for associated expansion modules in between.

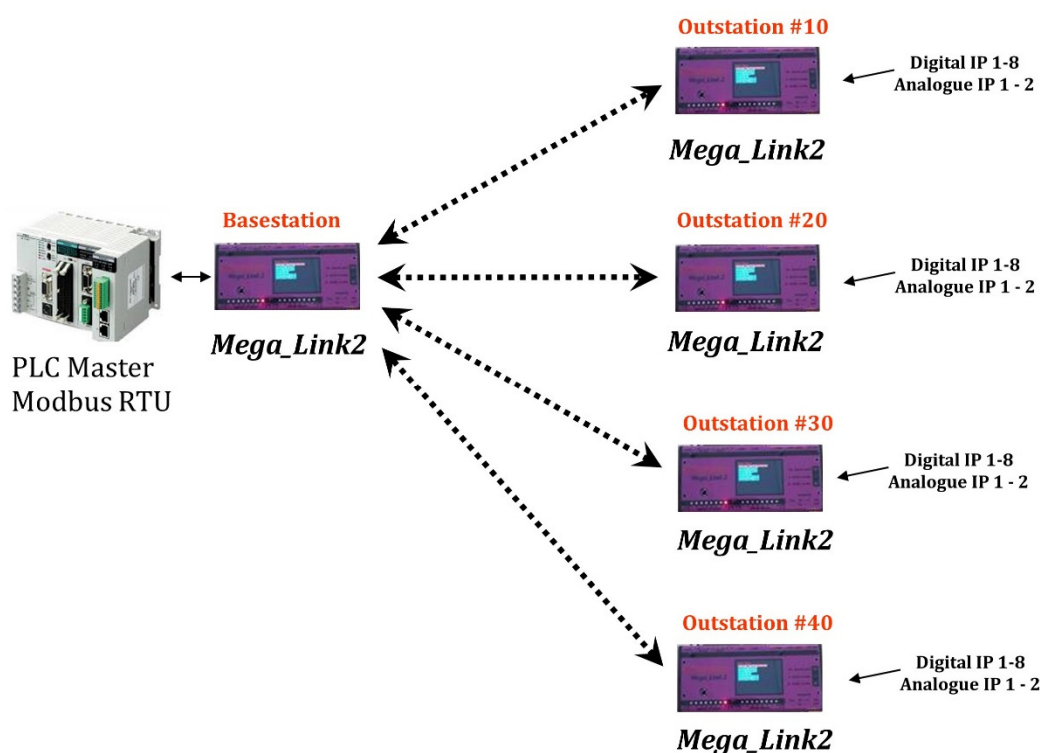
Each data block comprises 32 digital states (numbered 0...31) and 8 registers (numbered 0...7). See Annex #1 for Root Data Block details.

Memory maps are given in the manual (and also shown for Mega_Link 2 in Annex #1).

In general, there are 32 digital states comprising of; 8 flags, (comms alarm flags, supply status, charging etc.), 8 digital inputs on the main unit and then 16 digital inputs allocated ready for expansion modules. Along with 8 analogue registers comprising of: 4 Digital counts, RSSI reading and the 2 analogue inputs on the main unit.

This is replicated for inputs and outputs.

Example 1 – No expansion modules



Outstation #10

The data blocks for Outstation #10 start at the following addresses;

$10 \times 32 = 320$ and the main digital inputs start at the 8th position in the block, hence $320 + 8 = 328$

$10 \times 8 = 80$ and the main analogue inputs start at the 6th position in the block, hence $80 + 6 = 86$

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02 Read Discrete Inputs (1x)	Address	04 Read Input Registers (3x)	Address
Digital I/P #1	328	Analogue I/P #1	86
Digital I/P #2	329	Analogue I/P #2	87
Digital I/P #3	330		
Digital I/P #4	331		
Digital I/P #5	332		
Digital I/P #6	333		
Digital I/P #7	334		
Digital I/P #8	335		

Outstation #20

The data blocks for Outstation #20 start at the following addresses;

$20 \times 32 = 640$ and the main digital inputs start at the 8th position in the block, hence $640 + 8 = 648$

$20 \times 8 = 160$ and the main analogue inputs start at the 6th position in the block, hence $160 + 6 = 166$

02 Read Discrete Inputs (1x)	Address	04 Read Input Registers (3x)	Address
Digital I/P #1	648	Analogue I/P #1	166
Digital I/P #2	649	Analogue I/P #2	167
Digital I/P #3	650		
Digital I/P #4	651		
Digital I/P #5	652		
Digital I/P #6	653		
Digital I/P #7	654		
Digital I/P #8	655		

Outstation #30

The data blocks for Outstation #30 start at the following addresses;

$30 \times 32 = 960$ and the main digital inputs start at the 8th position in the block, hence $960 + 8 = 968$

$30 \times 8 = 240$ and the main analogue inputs start at the 6th position in the block, hence $240 + 6 = 246$

02 Read Discrete Inputs (1x)	Address	04 Read Input Registers (3x)	Address
Digital I/P #1	968	Analogue I/P #1	246
Digital I/P #2	969	Analogue I/P #2	247
Digital I/P #3	970		
Digital I/P #4	971		
Digital I/P #5	972		
Digital I/P #6	973		
Digital I/P #7	974		
Digital I/P #8	975		

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Outstation #40

The data blocks for Outstation #30 start at the following addresses;

$40 \times 32 = 1280$ and the main digital inputs start at the 8th position in the block, hence $1280 + 8 = 1288$

$40 \times 8 = 320$ and the main analogue inputs start at the 6th position in the block, hence $320 + 6 = 326$

02 Read Discrete Inputs (1x)	Address	04 Read Input Registers (3x)	Address
Digital I/P #1	1288	Analogue I/P #1	326
Digital I/P #2	1289	Analogue I/P #2	327
Digital I/P #3	1290		
Digital I/P #4	1291		
Digital I/P #5	1292		
Digital I/P #6	1293		
Digital I/P #7	1294		
Digital I/P #8	1295		

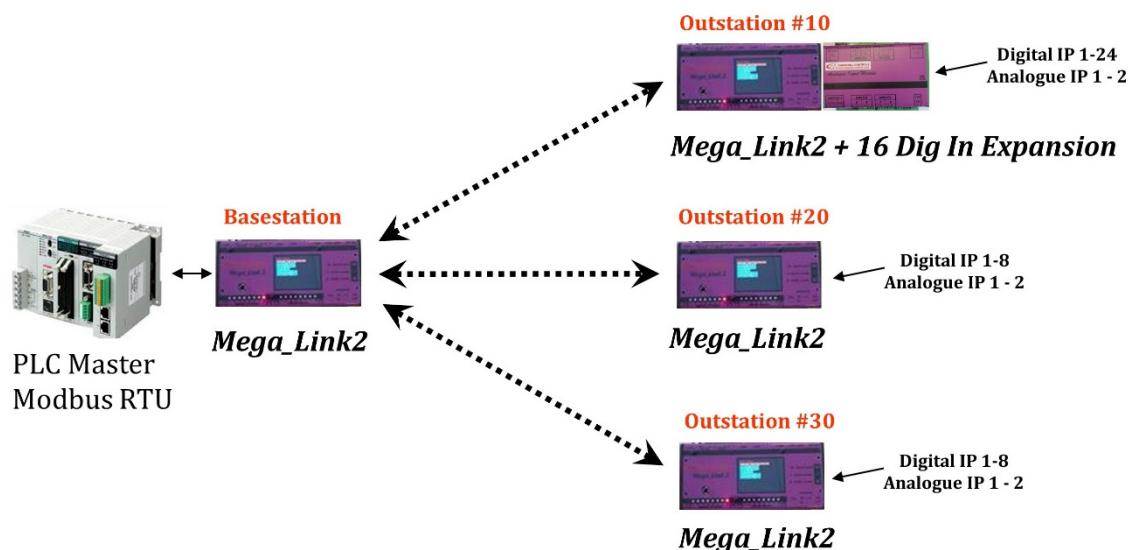
Example 2 – With expansion modules for 16 extra Digital Inputs

When Outstation #10 is fitted with a Digital Input expansion:

Mega_Link - 2x 7610-1 8 input Digital Input Expansion modules.

Mega_Link 2 - 1x 7850-1 16 input Digital Input Expansion module.

Micro_Link - 1x 7150-1 16 input Digital Input Expansion module.



Outstation #10

02 Read Discrete Inputs (1x)	Address	04 Read Input Registers (3x)	Address
Digital I/P #1	328	Analogue I/P #1	86
Digital I/P #2	329	Analogue I/P #2	87

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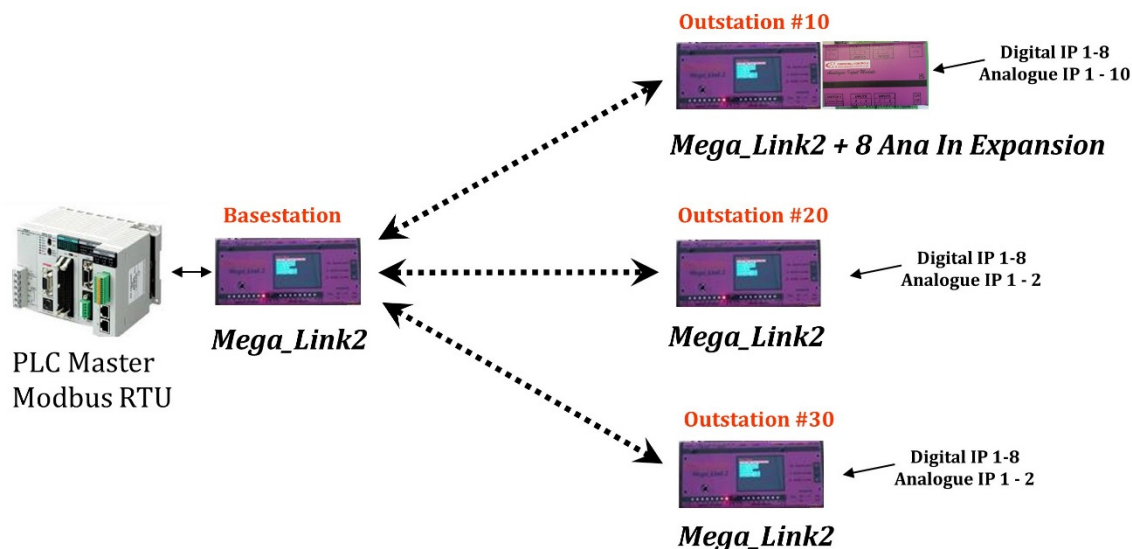
Digital I/P #3	330		
Digital I/P #4	331		
Digital I/P #5	332		
Digital I/P #6	333		
Digital I/P #7	334		
Digital I/P #8	335		
Digital I/P #9	336		
Digital I/P #10	337		
Digital I/P #11	338		
Digital I/P #12	339		
Digital I/P #13	340		
Digital I/P #14	341		
Digital I/P #15	342		
Digital I/P #16	343		
Digital I/P #17	344		
Digital I/P #18	345		
Digital I/P #19	346		
Digital I/P #20	347		
Digital I/P #21	348		
Digital I/P #22	349		
Digital I/P #23	350		
Digital I/P #24	351		

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Example 3 – With expansion modules for 8 extra Analogue Inputs

When Outstation #10 is fitted with an Analogue Input expansion:

Mega_Link - 2x 7620-1 4 input Analogue Input Expansion modules.
Mega_Link 2 - 1x 7860-1 8 input Analogue Input Expansion modules.
Micro_Link - 1x 7160-1 8 input Analogue Input Expansion modules.



Outstation #10

02 Read Discrete Inputs (1x)	Address	04 Read Input Registers (3x)	Address
Digital I/P #1	328	Analogue I/P #1	86
Digital I/P #2	329	Analogue I/P #2	87
Digital I/P #3	330	Analogue I/P #3	88
Digital I/P #4	331	Analogue I/P #4	89
Digital I/P #5	332	Analogue I/P #5	90
Digital I/P #6	333	Analogue I/P #6	91
Digital I/P #7	334	Analogue I/P #7	92
Digital I/P #8	335	Analogue I/P #8	93
		Analogue I/P #9	94
		Analogue I/P #10	95

Please note that the extra 8 Analogue inputs (shown shaded) will automatically be polled as Outstation #11.
A new virtual outstation is automatically allocated into the scanning sequence.

Example 4 – With expansion modules for 32 extra Digital Inputs

When Outstation #10 is fitted with:

Mega_Link - 4x 7610-1 8 input Digital Input Expansion modules.

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Mega_Link 2 - 2x 7850-1 16 input Digital Input Expansion module.
 Micro_Link - 2x 7150-1 16 input Digital Input Expansion module.

Outstation #10

02 Read Discrete Inputs (1x)	Address	04 Read Input Registers (3x)	Address
Digital I/P #1	328	Analogue I/P #1	86
Digital I/P #2	329	Analogue I/P #2	87
Digital I/P #3	330		
Digital I/P #4	331		
Digital I/P #5	332		
Digital I/P #6	333		
Digital I/P #7	334		
Digital I/P #8	335		
Digital I/P #9	336		
Digital I/P #10	337		
Digital I/P #11	338		
Digital I/P #12	339		
Digital I/P #13	340		
Digital I/P #14	341		
Digital I/P #15	342		
Digital I/P #16	343		
Digital I/P #17	344		
Digital I/P #18	345		
Digital I/P #19	346		
Digital I/P #20	347		
Digital I/P #21	348		
Digital I/P #22	349		
Digital I/P #23	350		
Digital I/P #24	351		
Digital I/P #25	352		
Digital I/P #26	353		
Digital I/P #27	354		
Digital I/P #28	355		
Digital I/P #29	356		
Digital I/P #30	357		
Digital I/P #31	358		
Digital I/P #32	359		
Digital I/P #33	360		

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Digital I/P #34	361		
Digital I/P #35	362		
Digital I/P #36	363		
Digital I/P #37	364		
Digital I/P #38	365		
Digital I/P #39	366		
Digital I/P #40	367		

Please note that the extra 16 Analogue inputs beyond example 1 (shown shaded) will automatically be polled as Outstation #11. A new virtual outstation is automatically allocated into the scanning sequence.

Annex #1

Mega Link 2 Root Data Block - Digitals

Input Digitals		Output Digitals	
0	Comms Fail Alarm	0	
1	Battery Low Alarm	1	
2		2	
3		3	
4		4	
5	Mains Fail Alarm	5	
6	Primary Comms Fail Alarm	6	
7	Secondary Comms Fail Alarm	7	
8	Digital Input 1	8	Digital Output 1
9	Digital Input 2	9	Digital Output 2
10	Digital Input 3	10	Digital Output 3
11	Digital Input 4	11	Digital Output 4
12	Digital Input 5	12	Digital Output 5
13	Digital Input 6	13	Digital Output 6
14	Digital Input 7	14	Digital Output 7
15	Digital Input 8	15	Digital Output 8
16	Digital Input 9 ¹	16	Digital Output 9 ²
17	Digital Input 10 ¹	17	Digital Output 10 ²
18	Digital Input 11 ¹	18	Digital Output 11 ²
19	Digital Input 12 ¹	19	Digital Output 12 ²
20	Digital Input 13 ¹	20	Digital Output 13 ²
21	Digital Input 14 ¹	21	Digital Output 14 ²
22	Digital Input 15 ¹	22	Digital Output 15 ²
23	Digital Input 16 ¹	23	Digital Output 16 ²
24	Digital Input 17 ¹	24	Digital Output 17 ²
25	Digital Input 18 ¹	25	Digital Output 18 ²
26	Digital Input 19 ¹	26	Digital Output 19 ²
27	Digital Input 20 ¹	27	Digital Output 20 ²
28	Digital Input 21 ¹	28	Digital Output 21 ²
29	Digital Input 22 ¹	29	Digital Output 22 ²
30	Digital Input 23 ¹	30	Digital Output 23 ²
31	Digital Input 24 ¹	31	Digital Output 24 ²

All alarm bits are '1' in the normal state and '0' when in alarm

NOTES

¹ Only available if a digital input expansion module is fitted, otherwise read '0'

² Only available if a digital output expansion module is fitted, otherwise ignored

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Mega Link 2 Root Data Block – Analogues

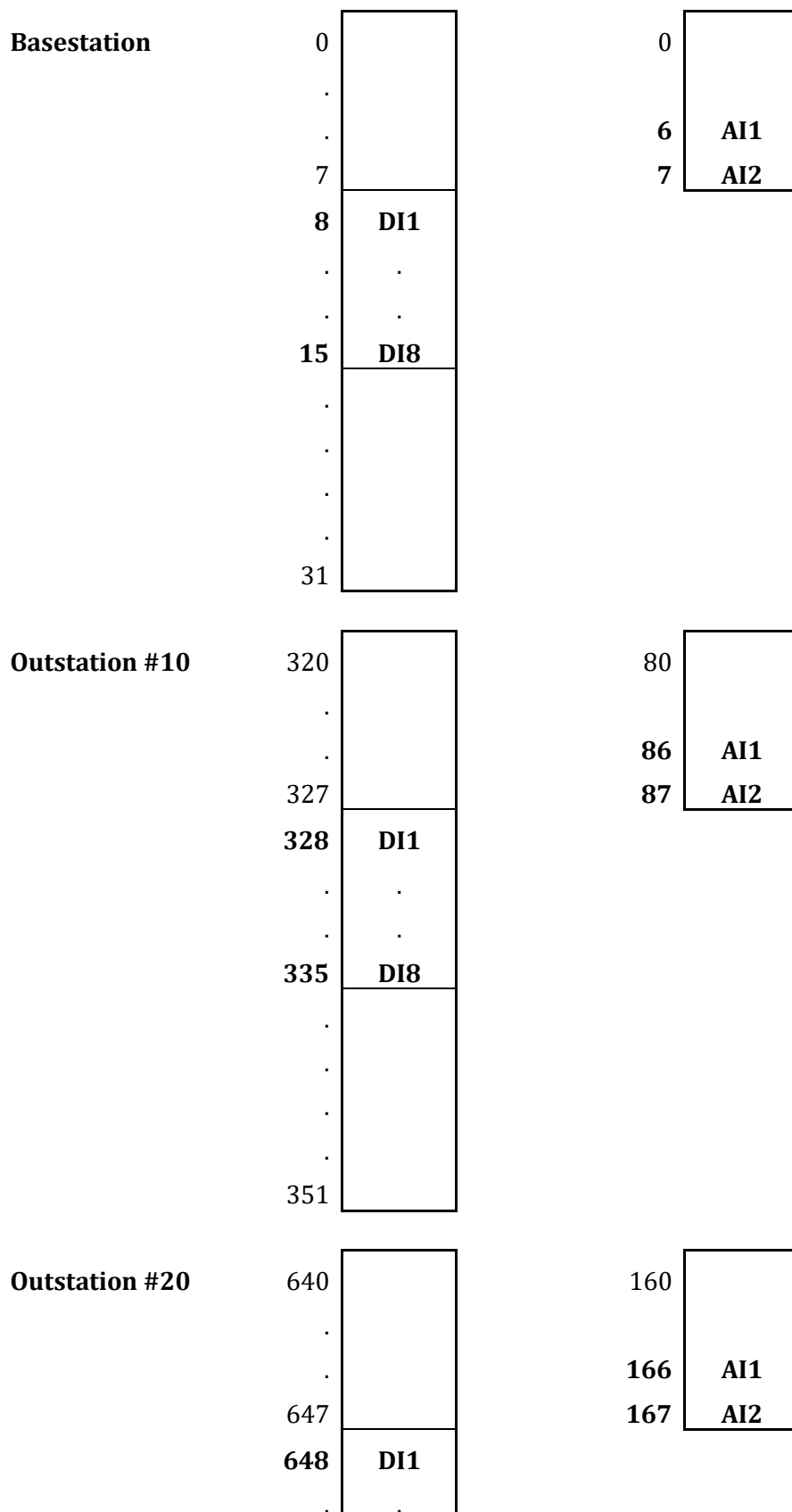
Input Registers

0	Count for digital IP 1
1	Count for digital IP 2
2	Count for digital IP 3
3	Count for digital IP 4
4	Battery Volts
5	Radio Received Signal Strength (RSSI)
6	Analogue Input 1
7	Analogue Input 2

Output Registers

0	
1	
2	
3	
4	
5	
6	Analogue Output 1
7	Analogue Output 2

Annex #2 – Modbus Address Diagram for Digital & Analogue Inputs (Outputs are the same)



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655	DI8
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671	

Outstation #30

960	
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.	
967	
968	DI1
.	.
.	.
965	DI8
.	
.	
.	
.	
991	

240	
246	AI1
248	AI2

Outstation #40

1280	
.	
.	
1287	
1288	DI1
.	.
.	.
1295	DI8
.	
.	
.	
.	
1311	

320	
326	AI1
327	AI2

End.

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