



- Modbus has four tables/registers where data is stored along with their associated addresses. We will be using the holding registers from address 40001 to 49999 that are R/W 16 bit/Word.
 - Two tables that store basic discrete values called coils (1 bit or Bool):
 - Two tables that store 16 bit numerical values called registers (16 bits or Word or INT)

coils - read/write	00001 - 09999
discrete inputs - read only	10001 - 19999
input registers - read only	30001 - 39999
holding registers - read/write	40001 - 49999

Initial connection to the Modbus master can be used with LR Device if your firmware is v2 for the block and LRD is at least v1.3.1.120, then IoT configuration is done by a direct connection to your laptop (no switch) and then "Read" from LR Device.

Don't forget to set your fieldbus port as well and connect both Ethernet ports. (See webserver screen shot below for details, this is the AL1340 IO Link master).

	iO-Link Master 4 Port Open Modbus/TCP							
Port	Mode	Comm. Mode	MasterCycleTime	Vendor ID	Device ID	Name	Serial	
1	IO-Link	38.4 kBaud	3.9 ms	0136	000103	PI2789	W0052120912	
2	Digital in	4.8 kBaud	0.0 ms	0000	000000			
3	IO-Link	230.4 kBaud	3.8 ms	0136	000338	E30443	B00501506183	
4	IO-Link							
	Supervision SW-Version Current Voltage Short Circuit Overload Undervoltage Temperature		Vetro 3 171mA 23641mV 0 0 0 0 47*C					
	Software		Version					
	Container	,	AL1x4x cn mo v2.1.32					
	Bootloader		AL1xxx bl f7 v1.2.0					
	Fieldbus Firmware	2	6.0.5 (Open Modbus/TCP)					

Will use a Generic Modbus tester with similar settings below to get started. If getting errors, reset power to the block, also try limiting the # of registers from 10 to 3 for example, for testing.

Port: Baud: F TCP/IP ▼ 38400 ▼ 1	°anity: Even _▼	Display M C Decin	ode- nial	C Hex	Maximum Transaction 10 Time in ms:
Communications Wiring: Wiring with No Ech	no (4-wire) 🔻	401001	•>	0	Transaction 0 Time in ms:
TCP/IP Address or URL:		401002	->	0	Transaction 10
172.21.52.99		401003	•	0	Protocol
Sample Mode: Manual	-	401004	->	0	Modbus
Timenut in ms: 20000 Sample Bate in n	1		_		C Jbus
	10. 1	401005	•>	0	~ Modbus
Data Type: Holding Register (R03 / W16)		401005	* *	0	C Modbus ASCII
Data Type: Holding Register (R03 / W16) Slave ID:Starting Register: #	▼ t of Registers:	401005 401006 401007	> -> ->	0	C Modbus ASCII
Data Type: Holding Register (R03 / W16) Slave ID: Starting Register: # 1 [1001]	t of Registers: 10	401005 401006 401007 401008	> > >	0 0 0	C Modbus ASCII Stop Read
Data Type: Holding Register (R03 / W16) Slave ID: Starting Register: # 1 [1001]	t of Registers:	401005 401006 401007 401008 401009	> > > >	0 0 0 0	C Modbus ASCII Stop Read Write





- Use the IP address of the Ethernet port for the Modbus tester and the IoT port for the webserver and LR Device.
- (READ EXERCISE) Hook up an IO Link sensor to a port... using PI2789 on port 1 for example. To change the port, the starting register would be 2001 for port 2, 3001 for port 3, etc... (see pg 81 of manual for details).

This tool requires an offset that is why we are starting at register 1001 vs 1000 for port 1 and the data will start reading on holding register 401001.

Single	Port	Access
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		21513				
Register	Cor	ntents				
	Bits 8-15	Bits 0-7				
1000	Port X01: Digital Input - pin 2	Port X01: Digital Input - pin 4 (DI)				
1001	reserved	Port X01: → Mapping: PQI (→ p. 82)				
1002	Port X01: Input D	ata IO-Link (n bytes)				
1100	reserved	Port X01: Digital Output - pin 4 (DO)				
1101	Port X01: Output E	Data IO-Link (n bytes)				
2000	Port X02: Single Port Access (Mapp	Port X02: Single Port Access (Mapping: → Port X01 - register 10001101)				
3000	Port X03: Single Port Access (Mapp	Port X03: Single Port Access (Mapping: → Port X01 - register 10001101)				
4000	Port X04: Single Port Access (Mapp	ing: → Port X01 - register 10001101)				

In the screen shot (Modbus tester) register 401001 is 0 which means both pin 2 (bit 8) & pin 4 (bit 1) are not high. Register 401002 is 1 which means that bit 0 is high (IOL mode is enabled). Finally, register 401003 is reading 860 which is the raw data for the PI2789 (see the IODD pdf process data info below for details).

You have to divide by 4 to offset the two bits (860/4 = 215.0). The units are in mBar and there is a gradient of 0.1 so you have to multiply by (0.1), which means the display should be reading 21.5 mbar assuming you have mbar set in the unit parameter for the PI2789.

Port Baud: Parity: TCP/IP 38400 Even *	Display M C Decin	lode - nial	⊂ Hex	Maximum Transaction 10 Time in ms:
Communications Wining: Wining with No Echo (4-wire) 💌	401001	->	0	Transaction 10 Time in ms:
TCP/IP Address or URL:	401002	->	1	Transaction 10
172.21.52.99	401003	->	860	Protocol-
Sample Mode: Manual 💌	401004	•	0	Modbus
Timeout in ms: 1 Sample Hate in ms: 1 Data Tupe:	401005	•>	0	C Modbus
Holding Register (R03 / W16)	401006	->	0	ASUI
Slave ID: Starting Register: # of Registers:	401007	•>	0	Stop
1 1001 10	401008	•	0	Read
Automated Error Count: 0	401009	- >	0	Write
		_	-	

The process data for the PI2789







If you were to cause the sensor to change the pressure so that pin 2 goes high, then bit 8 will go high and register 401001 will now display 256. The DI Led on the AL1340 will also turn on.

TCP/IP -	Baud: 38400	Parity: Even	Display M © Decim	ode - nial	C Hex	Maximum Transaction 11 Time in ms:
Communications	Wiring: Wiring with N	io Echo (4-wire) 💌	401001	->	256	Transaction 11 Time in ms:
TCP/IP Address	or URL:		401002	•>	5	Transaction 11 Time in ms:
172.21.52.99			401003	->	5279	Protocol-
Sample Mode:	Manual	•	401004	->	0	Modbus
Timeout in ms: Data Tune:	20000 Sample Rat	te in ms:	401005	•>	0	C Jbus
Holding Registe	(R03 / W16)	•	401006	->	0	ASUI
	Starting Register	# of Registers:	401007	->	0	Stop
Slave ID:				-	0	Bead
Slave ID:	1001	10	401008	.>	I*	
Slave ID: 1 Automated Error (1001 Count: 0	10	401008	•> •>	0	Write

Additionally, if you were to change port 1 from IO Link mode to a digital input and caused output 1 (pin 4) to go high then bit 0 will go on and will get a "1" in register 401001.

You will also notice register 401002 is now reading "2" vs "1" because the IO Link sensor is no longer connected. The IO Link Led on the AL1340 will also turn on.

p n Generic Modbus/Jbus Tester	_	
Port: Baud: Parity: TCP/IP 38400 Even	Display Mode © Decimial C Hex	Maximum Transaction 10 Time in ms:
Communications Wiring: Wiring with No Echo (4-wire)	401001 -> 1	Transaction 10 Time in ms:
TCP/IP Address or URL:	401002 -> 2	Transaction 10
172.21.52.99	401003 -> 0	Protocol
Sample Mode: Manual	401004 -> 0	 Modbus
Timeout in ms: 20000 Sample Rate in ms: 1	401005 -> 0	C Jbus
Data Type: Holding Register (B03 / W16)	401006 -> 0	C ASCII
Slave ID: Starting Register: # of Registers:	401007 -> 0	Stop
1 1001 10	401008 .> 0	Read
Automated Error Count: 0	401009 .> 0	Write
Scheduled Transaction Count:	401010 -> 0	Exit

Finally, if you caused input 1 (pin 4 – bit 0) as well as input 2 (pin 2 – bit 8) you would then get "257" in register 401001.

^P Generic Modbus/Jbus Tester		
Port: Baud: Parity: TCP/IP	Display Mode	Maximum Transaction 8 Time in ms:
Communications Wiring: Wiring with No Echo (4-wire) -	401001 -> 257	Transaction 8 Time in ms:
TCP/IP Address or URL:	401002 -> 2	Minimum Transaction 8 Time in ms:
172.21.32.33	401003 -> 0	Protocol
Sample Mode: Manual	401004 -> 0	Modbus
Timeout in ms: 20000 Sample Rate in ms: 1	401005 -> 0	C Jbus
Holding Register (R03 / W16)	401006 -> 0	ASCII
Slave ID: Starting Register: # of Registers:	401007 -> 0	Stop
1 1001 10	401008 -> 0	Read
Automated Error Count:	401009 -> 0	Write
Scheduled Transaction Count:	401010 -> 0	Exit





- (WRITE EXERCISE Digital Output) In order to use the Generic Modbus Tester with a 10 register limit, we have to change the IO Link I/O size to be either 2 or 4 or 8 bytes.
- Will change port 4 to be a digital output and change the I/O size from 32 bytes to 2 bytes using line recorder device sw.

Remember, there are two IP addresses on the AL1340, use the Ethernet/fieldbus for the Generic Modbus tester and the IoT IP for LR Device and the webserver.

🖯 DE	VICE							
2	Device catalogue							220
	Fast access	Q	<			Devic	e para	meters
Setup	ONLINE				Product ID:	AL1340	De	vice ID:
	Devices	+	All		Vendor:	ifm electronic gmbh	St	rial number:
	AL1340		Parameter	10 B 10 B	Auto refresh:			
Cockpit	(172.21.52.98)		IoT					
	P1: PM1709	1	Eieldhus	-				
	P2		Theorem	Parameter	_	Value	-	Unit
	P3: E30443	1	Port 1	DHCP		Static IP	*	
	P4	_	Port 2	ID address		170 01 50 00		
	OFFLINE	_	Port 3	in address		172.21.02.99		
	Manufacturer		Forts	Subnet mask		255.255.255.0		
	Itm electronic gmon		Port 4	Default gateway IP				
	Priorita Contact		Info	address		172.21.62.1		
			Firmware	MAC address		00:02:01:06:3F:95		
				Fieldbus firmware		2.6.0.5 (Open Modbus/TCP)		
				connectiontimeout			10000	ms
				Process data length		2 Bytes Input 2 Bytes Output	*	
				Swap		off	~	



(172.21.5	52.98/web/				C Q Search
🙆 Most Visited 🔇	Ġ Google 🔒 Bookmarks 🧐 ifm inti	ranet 🛞 Wiki US 🚺 ifm Portal 🧃 FileCloud User G	iuide 🗐 FileCloud usmanclo 🛞 Service Center Wait Ti 🧐 Iter	n Availability 🗰 Cisco Finesse 🛞 Cisc	o Unified Workfor 🛞 SAP Training
			6 IO-Link Master 4 Por	t Open Modbu	s/TCP
Port	Mode	Comm. Mode	MasterCycleTime	Vendor ID	Device ID
1	IO-Link	38.4 kBaud	4.8 ms	0136	00029B
2	Digital in	4.8 kBaud	0.0 ms	0000	000000
3	IO-Link	230.4 kBaud	3.8 ms	0136	000338
4	Digital out	4.8 kBaud	0.0 ms	0000	000000

From the manual on pg 42 see the register area. Register 4100 (plus 1 for offset)

Register area		Contents			
Start address	Length (words)				
1100	1	Port X01: Digital Output - Pin 4 (DO)	r/w		
1101	n/2	Port X01: Output Data IO-Link (n bytes)	r/w		
2100	1	Port X02: Digital Output - Pin 4 (DO)	r/w		
2101	n/2	Port X02: Output Data IO-Link (n bytes)	r/w		
3100	1	Port X03: Digital Output - Pin 4 (DO)	r/w		
3101	n/2	Port X03: Output Data IO-Link (n bytes)	r/w		
4100	1	Port X04: Digital Output - Pin 4 (DO)	r/w		
4101	n/2	Port X04: Output Data IO-Link (n bytes)	r/w		





From the Generic Modbus Tester will set the last bit of the first register to "1" to turn on pin 4 of port 4 on the AL1340 causing the IO Link Led to turn on and 24vdc on pin 4.

Port: TCP/IP -	Baud:	Parity: Even 💌	Display M	ode- nial	C Hex	Maximum Transaction 4 Time in ms:	
Communications V	Viring: Wiring with N	o Echo (4-wire) 🔻	404101	•>	1	Transaction 4	
TCP/IP Address o	r URL:		404102	•>	0	Minimum Transaction 2 Time in ms:	
172.21.52.99			404103	•	0	Protocol	
Sample Mode:	Manual	<u> </u>	404104	- >>	0	• Modbus	
Timeout in ms: Data Tupe:	Sample Rat	ein ms: l'	404105	•>	0	C Modbus	
Holding Register	(R03 / W16)	•	404106	->	0	ASUI	
Slave ID:	Starting Register:	# of Registers:	404107	->	0	Stop	
1	4101	10	404108	•>	0	Read	
	0		404109	•>	0	Write	
Automated Error C	ount: 1º						

- (WRITE EXERCISE IO Link mode)
- Will use port 3 in IO Link mode and change the I/O size from 32 bytes to 2 bytes using line recorder sw. Remember, there are two IP addresses on the AL1340, use the Ethernet/fieldbus for the Generic Modbus tester and the IoT IP for LR Device and the webserver.
- Shown below is the webserver showing port 3 and the sensor we are using is ifm p/n UA0041 which is a 4-20mA output module that is made by Phoenix Contact (p/n 2700275) and has a different name as shown.

The I/O size is still set to 2 bytes from the previous exercise, so no change has been made.

			🛅 IO-Link Mas	ster 4 Port Op	en Modbus/]	ГСР
Port	Mode	Comm. Mode	MasterCycleTime	Vendor ID	Device ID	Name
1	IO-Link					
2	Digital in	4.8 kBaud	0.0 ms	0000	000000	
3	IO-Link	230.4 kBaud	2.5 ms	00B0	01003C	AXL E IOL AO1 I M12 R
4	Digital out	4.8 kBaud	0.0 ms	0000	000000	

- You can get details on the device from the website at (https://www.phoenixcontact.com/pi/products/2700275). The device uses output data as follows for the 4-20mA signal.
 - 4mA signal.....0 (decimal) Start
 - 20mA signal.....27648 (decimal) End

13.2 S7-compatible format

Resolution: 1 bit (0000 -> 0008) accords 4,63 µA.

Output data		Range	4 mA 20 mA	
hex	dec		mA	
> 7F00	> 32512	Overrange	1.185	
7EF8	32504	Overdrive range (End)	22.81	
6C08	27656	Overdrive range (Start)	20.00463	
6C00	27648	Nominal range (End)	20.0	
3600	13824	Nominal range	12.0	
0008	8	Nominal range	4.00463	
0000	0	Nominal range (Start)	4.0	
FFF8	-8	Underdrive range (Start)	3.995	
ED00	-4864	Underdrive range (End)	1.185	
< ED00	< -4864	Underrange	1.185	





Starting register for port 3 Output Data is 3101, but you have to add 1 for the Modbus Tester offset... so will enter in 3102.

gle Port Acces	\$\$			
Register	Contents			
	Bits 8-15	Bits 0-7		
1000	Port X01: Digital Input - pin 2	Port X01: Digital Input - pin 4 (DI)		
1001	reserved	Port X01: → Mapping: PQI (→ p. 82)		
1002	Port X01: Input Data IO-Link (n bytes)			
1100	reserved	Port X01: Digital Output - pin 4 (DO)		
1101	Port X01: Output Data IO-Link (n bytes)			
2000	Port X02: Single Port Access (Mapping: → Port X01 - register 10001101)			
3000	Port X03: Single Port Access (Mapping: → Port X01 - register 10001101)			
4000	Port X04: Single Port Access (Mapping: → Port X01 - register 10001101)			

- Will use an AC1422 (ASi gateway) webserver and an AC2216 (analog input module) to read the output data for verification from the UA0041 (output module).
- Starting at 0 (decimal) in the register will provide a 4mA signal. The slave information from the webserver will display this in counts 4mA=4000 counts (the lower value is port 2 on the slave showing 04004).