30 MODBUS

Important Note: *This feature is provided as a "Premium Feature (Beta)". Please see terms and disclaimers regarding this and other premium features outlined in the Limited Warranty section.*

The Arlyn UpScale Indicator can also be configured to output data using the Modbus Protocol. Modbus communication is a widely used industrial protocol that serves as a standard mode of communication between different devices. The protocol usually engages a Master (or Client) that queries or consumes data, and a Slave (or Server) that sources data. The Master can be a Programmable Logic Controller (PLC) or a Personal Computer (PC).

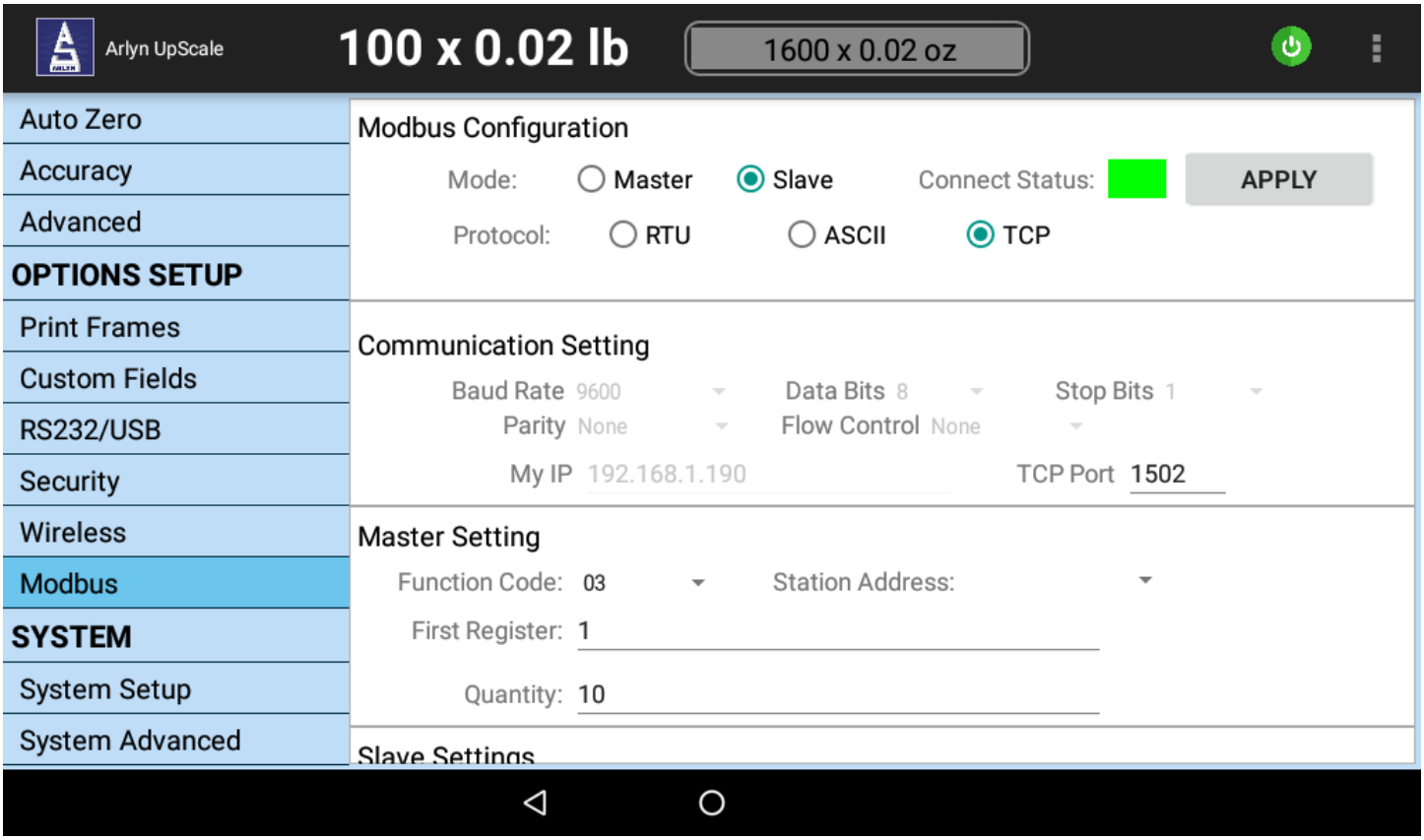
The Arlyn UpScale can support multiple Modbus Communication modes depending on the medium of communication. It can perform:

a. Modbus RTU or Modbus ASCII (w/ RS-232, RS-485, RS-422 and USB)
b. Modbus TCP (Ethernet, Wireless)

30.1 Modbus Communication Configuration

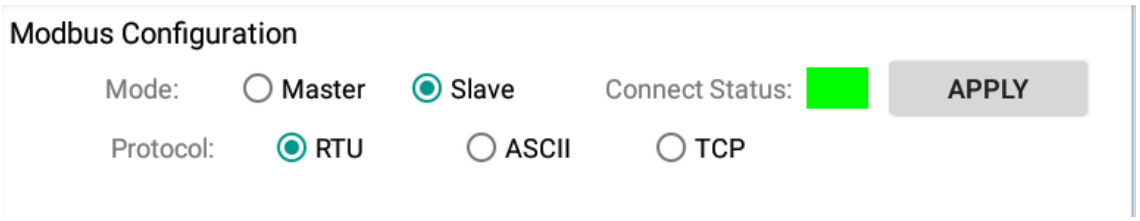
To configure the Modbus Communication protocol, press the 3-dot Action Menu on the top right corner of the screen and select Settings.

On the left hand (blue) panel, scroll down to OPTION SETUP header. Then press the **Modbus** option.



30.1.1 Transmission Modes

Use this region to select the desired Modbus Transmission mode.



Mode *Master* - Set the scale to be in Master Mode. *[Not Supported]*

Slave – Set the scale to be in Slave Mode.

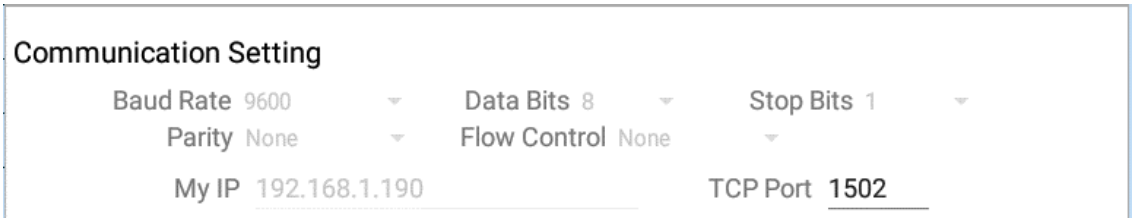
Protocol *RTU* – Remote Terminal Unit. This dictates the Modbus framework to transmit in Binary. This allows for greater density of characters which allows for the transmission of higher volume of data. Each byte (8 bits) in the message frame has 2 hexadecimal characters, 4 bits each.

ASCII – American Standard Code for Information Interchange. This mode allows for time intervals up to 1 second between characters during transmission without provoking an error. Each byte (8 bits) in the message frame is transmitted as two ASCII characters.

TCP – This mode is specifically for those applications that require Modbus TCP Protocol. This is only suitable for those scales equipped with Ethernet or Wi-Fi Communication options.

30.1.2 Communication Settings

Use this region to configure the Transmission parameters.



Serial Transmission (RTU/ASCII) Use the following parameters to set Serial Transmission properties.

Baud Rate
Data Bits
Stop Bits
Parity
Flow Control

IP Address and Port (TCP) If the transmission mode is set to Modbus TCP, and the scale is equipped with Ethernet or Wi-Fi, these parameters are relevant.

IP Address field will show the current IP Address of the scale as obtained from your network.

TCP Port is set to 1502. It can be changed to any number above 1000.

30.1.3 Master Setting [Not Supported]

The Master Mode on the scale is currently not supported.

30.2 Testing using Modbus Tools

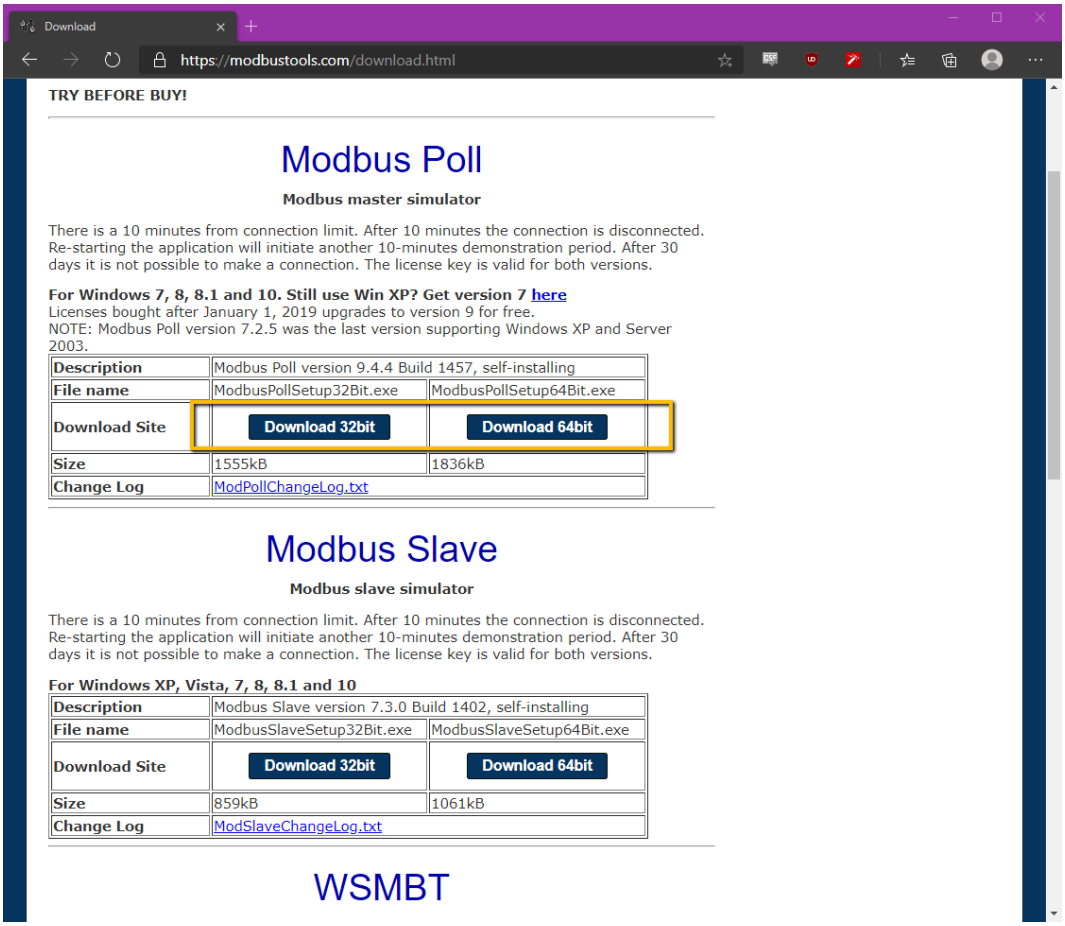
To demonstrate the workings of Modbus protocol available with the scale, follow the procedures outlined below.

30.2.1 "Modbus Poll" Utility

The "Modbus Poll" program is a PC program used to test the Modbus output from a Slave Instrument. In this case, the scale is the Slave and the Modbus Poll program is the Master.

Download the utility.

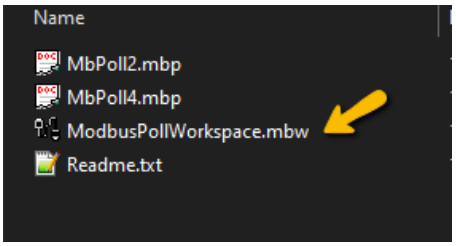
1) Go to https://modbustools.com/download.html and download the Modbus Poll (32-bit or 64-bit depending on your PC).



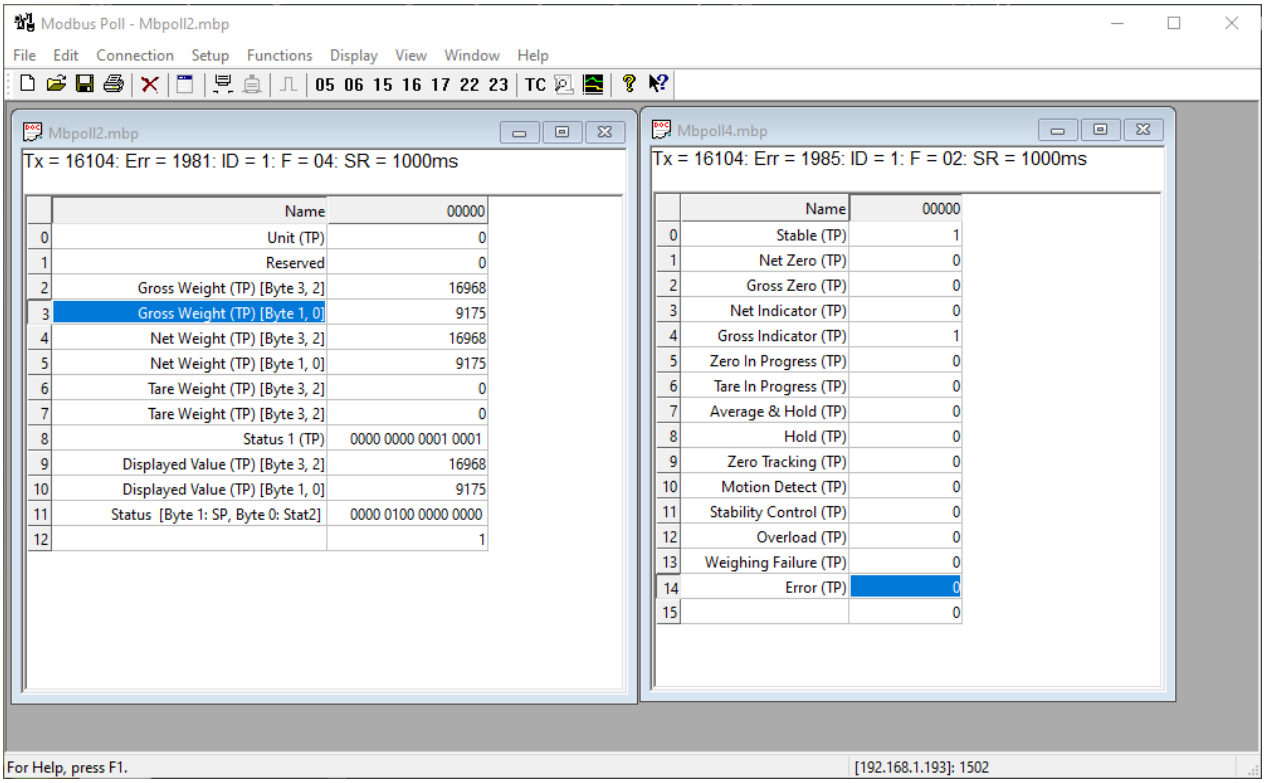
2) Once downloaded, install the utility in your PC. Please note that this is a trial version that is available to you for 30 days. It can be operated 10 minutes at time.
3) Run it once to see if it is installed properly. Do not worry if it does not connect to your scale yet.

The Modbus Workspace

4) Arlyn had prepared a pre-configured workspace that already parses data incoming from the scale with minimal configuration. Proceed to https://www.arlynscales.com/modbuspollworkspace/ and download the workspace ZIP file.
5) Unzip the file and click on the "ModbusPollWorkspace.mbw" file.



6) This should open up the workspace with two windows.



7) At this point, you may see Time out errors or No Connection errors. This is OK. We first need to connect to your scale.

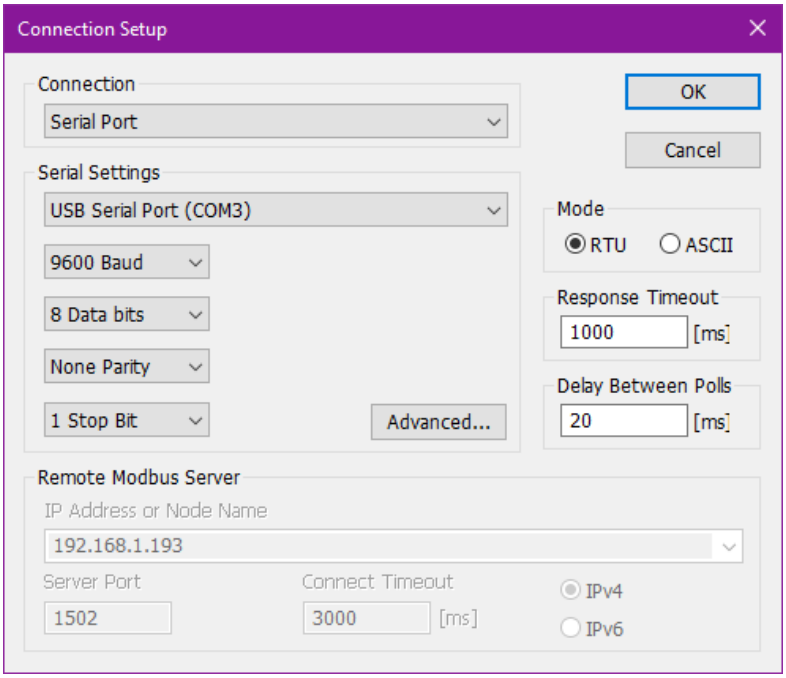
30.2.2 Modbus RTU/ASCII

The Modbus RTU or ASCII protocol usually works through the Serial Communication medium. Follow the steps below to demonstrate this communication protocol.

1) Configure the scale for Modbus RTU or ASCII using the parameters described in Modbus Communication Configuration section.
2) Set communication parameters or leave them at default. The default parameters for serial communication are:

   Baud Rate- 9600 bps
   Data Bits - 8
   Stop Bits- 1
   Parity - None
   Flow Control - None
3) Connect the scale to the PC (either through USB, RS-232, RS-485, etc).
4) In the Modbus Poll workspace, on the top Menu bar, click on Connection->Connect…

5) The “Connection Setup” screen is shown. Set the connection configuration as below.



Please note the Serial Settings “COM port” needs to be according to what is shown in your Device Manager. This is the COM # assigned to your scale. For more details on determining your COM port assigned by the PC, see the sections RS-232 Communication Port or USB Communication (Virtual Serial Port).

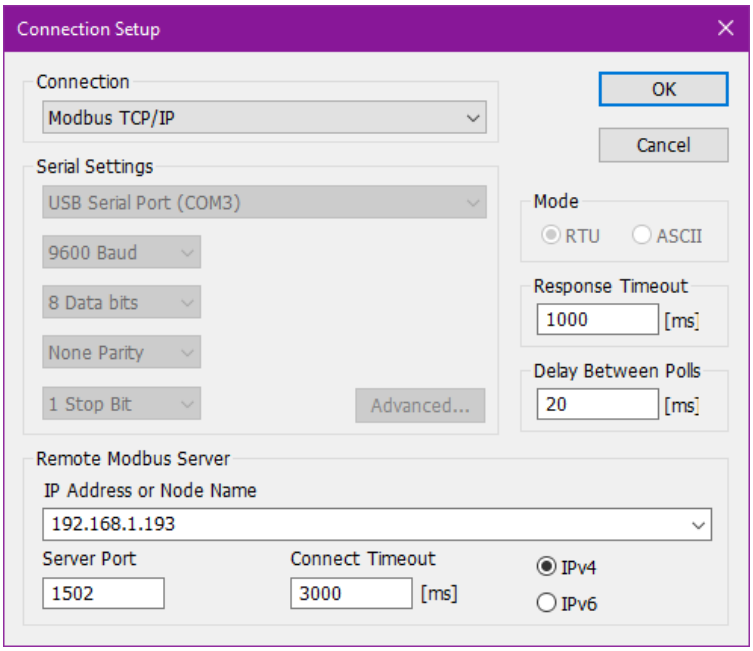
6) For the “Mode”, you can choose to demonstrate RTU or ASCII. Please make sure that this selection matches whatever the configuration you have on the scale (Default: RTU).
7) Press OK to confirm.

If the configuration is correct and all the parameters are matched, you will now see activity in the MbPoll2 and MbPoll4 windows. Press on the platform to notice the data changing accordingly.

The next section describes testing the scale with Modbus TCP. If your scale is only equipped with Serial Communication, then skip this section and proceed to Data Areas.

30.2.3 Modbus TCP

1) Connect the scale to your Local Area Network (plug an Ethernet RJ-45 cable to the provided jack on the scale).
2) In the Modbus Configuration Screen select the Protocol to be Modbus TCP.
3) Make sure a valid IP Address can be seen in the “Communication Settings” on the Modbus Configuration Screen.
4) In the Modbus Poll workspace, on the top Menu bar, click on Connection->Connect…
5) The “Connection Setup” screen is shown. Set the connection configuration as below.

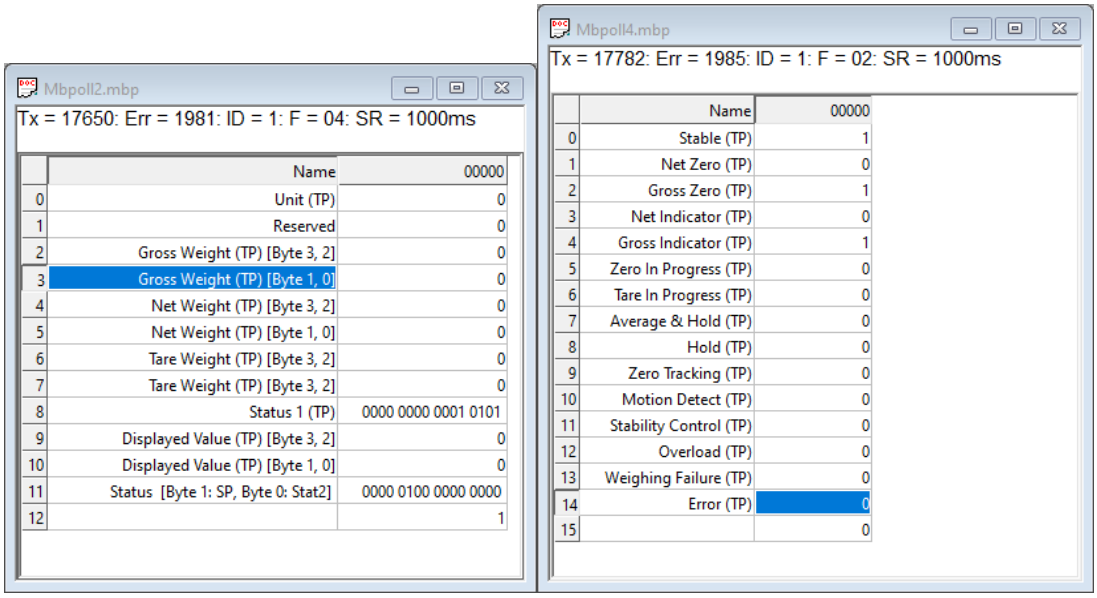


6) In the "Remote Modbus Server" group, type in the IP Address of the scale as shown in the "Communication Settings" in Modbus Settings.
7) Type in the Port number. The default is 1502 (as set on the scale).
8) Press the OK button to confirm.

If the configuration is correct and all the parameters are matched, you will now see activity in the MbPoll2 and MbPoll4 windows. Press on the platform to notice the data changing accordingly.

30.2.4 MbPoll (Monitoring) Windows

The MbPoll Windows shown in the Modbus Poll Utility Workspace demonstrates various active addresses in the scale from which data is being retrieved.



The Mbpoll2 window shown above shows data from registers addresses 30001-30013 (*Function 04, Input Registers).* The Mbpoll4 window shown above shows from register addresses 10001-10016 (*Function 02, Input Status Registers, Bitwise*). The complete address map of the Modbus protocol is illustrated in the Data Areas section.

30.3 Data Areas (Registers)

Data Areas are regions in the scale with address spaces, each containing specific data to be queried or written through Modbus protocol.

The scale has three data areas:

*Input Registers (*Address Region 30000) [Read Only]
Input Status Registers (Address Region 10000) [Read Only]
Coils (Address Region 00000) [Write Only]

Holding Registers (Address Region 40000) are currently empty. All the data available on the scale can be read using the registers mentioned above.

The Data areas outlined below only show a snapshot for a single platform scale without options. For a complete Spreadsheet with all the data points, download the register map here: https://www.arlynscales.com/modbus-mapping-v1/. Please note these addresses are subject to change.

30.3.1 Input Registers (Address 30000)

The Input Register Data Area is read by the Master (PLC) and written by the scale. Each address is a WORD (16-bits, 2 bytes). The address space starts from 30001.

KIND	REG	ITEM	DESCRIPTION	NOTES
TOP PLATFORM				
	30001	Unit (Top Platform)	0: lb, 1: kg, 2: g, 3: oz, etc.	
Input Registers 30001 to 39999 (Slave -> Master) BIG ENDIAN	30002	Reserved		
	30003	Gross Weight value (Top Platform)	byte (3)	
			byte (2)	
	30004	Gross Weight value (Top Platform)	byte (1)	
			byte (0)	
	30005	Net Weight Value (Top Platform)	byte (3)	
			byte (2)	
	30006	Net Weight Value (Top Platform)	byte (1)	
			byte (0)	
	30007	Tare Weight Value (Top Platform)	byte (3)	
			byte (2)	
	30008	Tare Weight Value (Top Platform)	byte (1)	
			byte (0)	
	30009	Status 1 (Top Platform)	Data 16-bit "Input Status Registers", 10001 to 10016	
	30010	Displayed value (Top Platform)	byte (3)	
			byte (2)	
	30011	Displayed value (Top Platform)	byte (1)	
			byte (0)	
	30012	Status 2 (Top Platform)	Data 16-bit "Input Status Registers", 10017 to 10032	
	30013	Status 3 (Top Platform)	Data 16-bit "Input Status Registers", 10033 to 10048	
		30012-30099		

30.3.1.1 Input Register Notes

Format of GROSS WEIGHT, NET WEIGHT, TARE WEIGHT and DISPLAYED WEIGHT values

These values are presented in 4-byte Floating Point value. To read the whole weight, the 4 bytes presented must be interpreted as "floating point".

Format of Input Status Registers

For redundancy measures, the Input Status Registers are presented here in 30009, 30012 and 300013.

30.3.2 Input Status Registers (Address 10000)

KIND	REG	ITEM		DESCRIPTION	NOTES
TOP PLATFORM					
Coil Registers 10001 to 19999 (Slave-> Master) Bit Register (Each address maps to a bit) Status 1 - Top Platform (Also in Input Register 30009)	010001	Stable (Top Platform)	Bit 0	1: Green 0: Red	
	010002	Net Center of Zero (Top Platform)	Bit 1	1: "zr" indicator in Net mode	w/ Motion/Detect
	010003	Gross Center of Zero (Top Platform)	Bit 2	1: "zr" indicator in Gross mode	w/ Motion/Detect
	010004	Net Display (Top Platform)	Bit 3	1: Display Showing Net	
	010005	Gross Display (Top Platform)	Bit 4	1: Display Showing Gross	
	010006	Zero in Progress (Top Platform)	Bit 5	1: Zero in Progress	
	010007	Tare in Progress (Top Platform)	Bit 6	1: Tare in Progress	
	010008	Average & Hold in Progress (Top Platform)	Bit 7	1: Average & Hold in Progress	
	010009	Hold (Top Platform)	Bit 8	1: Weight Hold 0: Normal	
	010010	Zero Tracking (Top Platform)	Bit 9	1: "Zero Tracking" in progress	
	010011	Motion Detect (Top)	Bit 10	1: Motion 0: No Motion	
	010012	Stability Control (Top)	Bit 11	1: Stable 0: Unstable	
	010013	Overload (Top Platform)	Bit 12	1: Overload 0: Normal	
	010014	Weighing Failure (Top Platform)	Bit 13	1: Weight cannot be shown for some reason.	
	010015	Error (Top Platform)	Bit 14	1: Error	
	010016		Bit 15		
Status 2 - Top Platform (Also in Input Register 30010)	010017	Setpoint 1	Bit 0	1: ON 0: OFF	
	010018	Setpoint 2	Bit 1	1: ON 0: OFF	
	010019	Setpoint 3	Bit 2	1: ON 0: OFF	
	010020	Setpoint 4	Bit 3	1: ON 0: OFF	
	010021	Setpoint 5	Bit 4	1: ON 0: OFF	
	010022	Setpoint 6	Bit 5	1: ON 0: OFF	
	010023	Setpoint 7	Bit 6	1: ON 0: OFF	
	010024	Setpoint 8	Bit 7	1: ON 0: OFF	
	010025		Bit 8		
	010026	HI Output	Bit 9	(Weight or Parts Comparator)	
	010027	OK Output	Bit 10	(Weight or Parts Comparator)	
	010028	LO Output	Bit 11	(Weight or Parts Comparator)	
	010029	User input 1	Bit 12		
	010030	User input 2	Bit 13		
	010031	User input 3	Bit 14		
	010032		Bit 15		
Status 3 - Top Platform (Also in Input Register 30011)	010033	Net over	Bit 0		
	010034	Net under	Bit 1		
	010035	Gross Over	Bit 2		
	010036	Gross Under	Bit 3		
	010037	Input (A/D) over	Bit 4		
	010038	Input (A/D) under	Bit 5		
	010039	Zero correction error	Bit 6		
	010040	Tare error	Bit 7		
	010041	Net display error	Bit 8		
	010042		Bit 9		
	010043		Bit 10		
	010044	Checksum error	Bit 11		
	010045	A/D error	Bit 12		
	010046	FRAM error	Bit 13		
	010047	Calibration error	Bit 14		
	010048	Mode error	Bit 15		

30.3.3 Coils (Address 00000)

The Coils Data Area can be used to send commands to the scale from the Master. For example, if you want to ZERO the scale from the Master (e.g. PLC), sent ON (or 1) to address 00001 and the scale will zero out. Similarly, the same can be said about changing units, or taring, etc.

KIND	Reg	ITEM		DESCRIPTION	NOTES
TOP PLATFORM					
Coil Registers 00001 to 09999 (Master -> Slave) Bit Register (Each address maps to a bit) Commands to be sent from the PLC to the Scale	00001	Zero (Top Platform)	Bit 0	1: Execute	
	00002	Reserved	Bit 1	Future expansion for Zero operation	
	00003	Tare (Top Platform)	Bit 2	1: Execute	
	00004	Clear Tare Value (Top Platform)	Bit 3	1: Execute	
	00005	Change Unit (Top Platform)	Bit 4	1: Toggle to next active unit	
	00006	Net / Gross Display	Bit 5	1: Net 0: Gross	1: Toggle Net/Gross
	00007	Cycle (Top Platform)	Bit 6	1: Toggle Cycle (Abort Cycle)	1: Toggle
	00008	Average Weight & Hold (Top Platform)	Bit 7	1: Start 0: Stop	1: Toggle
	00009	Flow Rate	Bit 8	1: Start 0: Stop	1: Toggle
	00010	Log Weight	Bit 9		
	00011		Bit 10		
	00012		Bit 11		
	00013		Bit 12		
	00014	User Output 1	Bit 13	1: ON 0: OFF	NA
	00015	User Output 2	Bit 14	1: ON 0: OFF	NA
	00016	User Output 3	Bit 15	1: ON 0: OFF	NA
		00017 - 00099			