User manual for

CloudScale Neutron Modbus

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1. MANUAL VERSIONS

Version	Date	Description of change
1.0	June 2026	First Neutron Modbus manual release.

2. OVERVIEW

CloudScale Neutron NS and Neutron NT provide a Modbus interface for reading weighing data, status information, digital I/O and calibration data, and for executing selected scale commands. The interface is intended for PLC, SCADA, HMI, MES and custom software integrations.

Neutron supports the following Modbus transport variants:

- Modbus RTU through the RS-232 or RS-485 interface. The default Modbus slave / unit ID is 1.
- Modbus TCP through Wi-Fi or Ethernet. The default TCP port is 502.

The available functions and register areas are the same logical interface for Modbus TCP and Modbus RTU, except that TCP uses a Unit Identifier only where required by the client or gateway.

Important: Communication parameters such as serial port settings and network settings must be configured in Neutron before the Modbus master is connected. The device uses the Modbus address configured by parameter MBA.

3. CONNECTION AND ACTIVATION

3.1 MODBUS TCP

Modbus TCP is available through the network connection of the Neutron. Use the IP address assigned to the device and TCP port 502. TCP communication does not require a serial line configuration.

To use Modbus TCP you must select Modbus TCP under scale communication interfaces (parameter SCI). You can use Modbus TCP while also using other interfaces, for instance you can still use RS-232 for communication with computer via CSCP protocol.

Configuration	Result
SCI = 10	Enables Modbus TCP only.
SCI = 5,10	Enables normal RS-232 scale communication together with Modbus TCP.
SCI = 6,10	Enables normal RS-485 scale communication together with Modbus TCP.
MBA	Sets Modbus slave / unit address. Default: 1.
TCP port	502

Where several SCI values are shown, configure the interfaces according to the selected Neutron communication configuration. After applying configuration changes, restart communication or the device where required by the configuration menu.

3.2 TYPICAL TCP CONNECTION

Item	Example
Modbus master	PLC, SCADA, HMI or industrial PC
Transport	Ethernet or Wi-Fi TCP/IP
Target address	Neutron IP address
Service port	502
Unit ID	MBA value; default 1

For a stable industrial installation, Ethernet is recommended whenever a wired network is available. Wi-Fi adds network-dependent latency and should be assessed in the application environment.

3.3 MODBUS RTU (RS-232/RS-485)

Modbus RTU can be used through RS-232 or RS-485. The serial communication settings of the Modbus master must match the serial interface settings configured in Neutron. The Modbus slave ID is set by MBA and defaults to 1.

To use Modbus RTU you must select either Modbus RS-232 or Modbus RS-485 under scale communication interfaces (parameter SCI).

Interface	Typical wiring principle	Important note
RS-232	Connect TX, RX and GND between Neutron and the Modbus master. TX/RX may need to be crossed depending on whether the connected ports are DTE or DCE.	Use short point-to-point connections and a common signal ground.
RS-485	Connect A to A and B to B according to the terminal marking used by both devices; connect signal reference / GND where required by the installation.	Use a daisy-chain topology. Do not use star wiring. Apply line termination only at the two physical ends where required.

Always follow the Neutron terminal marking and the wiring diagram supplied with the device. Manufacturers do not always label RS-485 polarity in the same way; if no communication is established, verify the A/B polarity and the master configuration.

4. ADDRESSING AND DATA REPRESENTATION

This manual uses the conventional Modbus reference notation (for example, 40101). Many Modbus client tools use zero-based start addresses. In such tools, remove the leading register-area digit and subtract 1 from the reference address.

Reference notation	Zero-based start address	Example
40001	0	Holding register 40001
40101	100	Holding register 40101
40232	231	Holding register 40232
40380	379	Holding register 40380

Confirm the addressing convention of the Modbus master before commissioning. An offset error of one register is the most common reason for incorrect data interpretation.

4.1 WEIGHT FORMAT

- Gross, net and tare values are signed 32-bit integers stored in two consecutive 16-bit registers.
- The high word is transmitted first (big-endian register order).
- The decimal position is reported in the output / status configuration register, bits 14..13.
- High-resolution gross and net values use up to two additional decimal position when the high-resolution value is available.

Example: where the decimal-position field indicates 2 decimals, the signed 32-bit value 12345 represents 123.45 in the active unit. The unit is available in register 40113 and is also encoded in the output/status configuration register.

5. SUPPORTED MODBUS FUNCTIONS

Function	Name	Use in Neutron
01	Read Coils	Read digital output states (coils 1..6 map to DO1..DO6).
03	Read Holding Registers	Read writable and command-related registers.
04	Read Input Registers	Read process data, weights and status registers.
05	Write Single Coil	Set one digital output where output function is disabled.
06	Write Single Register	Write one holding register, including command-related fields.
15	Write Multiple Coils	Set multiple digital outputs where functions are disabled.
16	Write Multiple Registers	Write command, parameters and calibration data as a block.

Write operations to outputs controlled by a configured output function are rejected. Typical function-controlled outputs include tolerance and dosing outputs.

6. PROCESS DATA REGISTER MAP

6.1 MAIN PROCESS REGISTERS

Input / Holding reference	Description	Data type / notes
30001-30002 / 40001-40002	Gross weight	Signed INT32, big-endian register order.
30003-30004 / 40003-40004	Net weight	Signed INT32, big-endian register order.
30005 / 40005	Scale status	Bit field; see section 6.3.
30006 / 40006	Command status	Command processing state.
30007 / 40007	Output / status configuration	Bit field: outputs, unit and decimal position.

The main map allows simple masters to obtain net or gross weight and key status data using a small contiguous register range.

6.2 EXTENDED PROCESS REGISTERS

Holding register	Description	Data type / notes
40101-40102	Gross weight	Signed INT32.
40103-40104	Net weight	Signed INT32.
40105-40106	Tare weight	Signed INT32.
40107	Scale status	Bit field; see section 6.3.
40108	Output / status configuration	Bit field; see section 6.3.
40109-40110	Gross high-resolution	Signed INT32; one extra decimal where available.
40111-40112	Net high-resolution	Signed INT32; one extra decimal where available.
40113	Unit	0 = g; 1 = kg; 2 = t; 3 = lb.
40114	Digital input mask	Bits 0..5 = DI1..DI6.
40115	Digital output mask	Bits 0..5 = DO1..DO6.
40116	Output function mask	A set bit means the related output is function-controlled.
40117	ADC points	Raw ADC value.
40119	Millivolts	Load-cell signal in mV.
40231	Command status	Command processing state.
40232	Command	Write command code here.
40233	Command parameter 1	Optional parameter for the command in 40232.

6.3 STATUS AND CONFIGURATION BIT FIELDS

6.3.1 SCALE STATUS REGISTER (30005 / 40005 / 40107)

Bit	Meaning (if bit value=1)
0	Net weight is negative.
1	Gross weight is negative.
2	Weight is stable.
3	Underload condition.

4	Overload condition.
5	Tare is active.
6	Preset / manual tare is active.
7	Gross weight is zero.
8	Digital input 1 is active.
9	Digital input 2 is active.
10	Scale / ADC error is active.

6.3.2 OUTPUT / STATUS CONFIGURATION REGISTER (30007 / 40007 / 40108)

Bit(s)	Meaning
0..5	Digital output status: DO1..DO6.
6..7	Active unit code: 0 = g; 1 = kg; 2 = t; 3 = lb.
8	Scale / load-cell error.
13..14	Decimal-position code for standard weight values.

For applications that require all output states, use register 40115. Use register 40116 to determine which outputs are currently reserved by the active function.

7. COMMANDS AND DIGITAL OUTPUTS

7.1 COMMAND REGISTER OPERATION

Write a command code to holding register 40232. Write the optional parameter to 40233 before issuing the command. The command status can be read from 40231. Command code 0 clears the repeat guard and allows the same command to be executed again.

Command code	Parameter 40233	Action
0	-	No command; reset repeat guard.
1	0	Zero after stability check.
1	1	Zero immediately.
2	0	Tare after stability check.
2	1	Tare immediately.
3	-	Clear tare.
25	Output bit mask	Set digital outputs according to the bit mask.

Shortcut: writing the command code to holding register 40001 also executes the command. For predictable integration, the extended command registers 40232 and 40233 are recommended, particularly where a parameter is required.

7.2 DIGITAL OUTPUTS

- Coils 1..6 correspond to DO1..DO6.
- Use functions 01, 05 and 15 to read or write coils.
- An output can only be changed through Modbus when its output function is disabled.
- If an output is controlled by a tolerance, dosing or other active function, the device rejects Modbus writes to that output.

Example: To activate DO1 and DO3 with command code 25, write a bit mask of binary 000101 (decimal 5) to 40233 and then write 25 to 40232. Verify the result through register 40115 or coils 1..6.

8. CALIBRATION INTERFACE

Calibration is performed through holding registers. Successful calibration data are stored to flash memory. If calibration fails, the changed data are not saved.

8.1 CALIBRATION DATA

Holding reference	Zero-based start	Description
40300	299	Calibration status bit field.
40301	300	Scale channel.
40302	301	Number of decimals used for calibration weights.
40303	302	Number of valid calibration points.
40304-40305	303	Zero ADC point, signed INT32.

Calibration-status bit	Meaning
0	Zero point exists.
1	First calibration weight point exists.
2	Scale has the minimum valid calibration.
8	Scale / ADC error is active.

8.2 CALIBRATION POINT BLOCKS

Point 1 starts at 40310 (zero-based start 309). Each calibration point uses eight registers. The start register for point N is 40310 + ((N - 1) x 8).

Offset in point block	Description
+0	Valid flag: 0 = invalid; 1 = valid.
+1..+2	Calibration weight, signed INT32.
+3..+4	ADC point, signed INT32.
+5..+6	Factor x100, signed INT32.
+7	Reserved.

Examples: point 1 = 40310-40317; point 2 = 40318-40325; point 3 = 40326-40333; point 8 = 40366-40373.

8.3 CALIBRATION COMMANDS

Holding reference	Zero-based start	Description
40380	379	Command.
40381	380	Point number.
40382-40383	381	Calibration weight, signed INT32.
40384	383	Flags.
40385	384	Trigger.
40386	385	Command result.
40387	386	Last executed command.

Command	Description

1	Calibrate zero.
2	Calibrate weight point.
3	Delete calibration point.
4	Delete zero point.
5	Delete all calibration.
6	Reload / initialize scale.

Flags register 40384: bit 0 controls whether stability is required. A value of 0 executes immediately; a value of 1 requires a stable ADC average. All other flag bits are reserved.

Result 40386	Meaning
0	OK.
1	Incorrect command.
2	Bad data.
3	Not allowed.
4	Unsupported command.
5	Calibration failed.

8.4 TRIGGER SEQUENCE

Firmware processes calibration only when the trigger register 40385 changes to a non-zero value. Use the following sequence for every calibration command:

1. Write command and all required parameters.
2. Write 40385 = 1 to execute the operation.
3. Wait for command completion and read 40386.
4. Write 40385 = 0 to reset the trigger.
5. For the next command, write parameters and change 40385 to 1 again.

8.5 EXAMPLES

Command	Calibrate zero
Purpose	Write Multiple Registers starting at zero-based address 379.
Responses	
`40380 = 1`	Command: calibrate zero.
`40381 = 0`	Point number not used.
`40382 = 0; 40383 = 0`	Calibration weight not used.
`40384 = 1`	Require stable ADC average.
`40385 = 1`	Trigger operation.
`Read 40386`	Expected result: 0 (OK).

Command	Calibrate point 1 with 10.000 kg
Purpose	For 40302 = 3, scale the calibration weight by 1000.

Responses	
`40380 = 2`	Command: calibrate weight point.
`40381 = 1`	Point number 1.
`40382-40383 = 10000`	10.000 kg x 1000.
`40384 = 1`	Require stable ADC average.
`40385 = 1`	Trigger operation.
`Read 40386`	Expected result: 0 (OK).

Command	Delete point 1
Purpose	Remove the first calibration point.
Responses	
`40380 = 3`	Command: delete calibration point.
`40381 = 1`	Point number 1.
`40385 = 1`	Trigger operation.

Command	Delete all calibration
Purpose	Remove all stored calibration data.
Responses	
`40380 = 5`	Command: delete all calibration.
`40385 = 1`	Trigger operation.

9. COMMISSIONING AND TROUBLESHOOTING

9.1 RECOMMENDED COMMISSIONING SEQUENCE

1. Configure SCI for the required interface combination and set MBA to the required Modbus slave / unit ID.
2. For Modbus TCP, confirm IP address and connect to TCP port 502. For Modbus RTU, match serial parameters and verify the wiring.
3. Read a known register such as 40113 (unit) or 40107 (scale status) to validate addressing.
4. Read 40101-40106 and decode the signed 32-bit gross, net and tare values using the reported decimal position.
5. Verify scale status, digital inputs and outputs before enabling control functions.
6. Use command registers and calibration functions only after confirming that the correct scale channel and application state are active.

9.2 COMMON ISSUES

Symptom	Likely cause	Action
No Modbus response	Scale communication interface (SCI) is not configured for the selected interface; wrong IP/port or serial settings; incorrect wiring.	Verify SCI, TCP port 502, MBA, network reachability, serial parameters and physical wiring.
Values appear shifted or invalid	Client uses an incorrect reference / zero-based register conversion; 32-bit words decoded in wrong order.	Check the client addressing convention and use signed INT32 with big-endian register order.
Weight has wrong decimal position	Client ignores decimal-position configuration or high-resolution format.	Read 40108 and apply bits 14..13; use high-resolution registers only when required.

Output cannot be written	Output is controlled by an assigned function.	Read 40116 and disable the relevant output function before controlling the output via Modbus.
Same command does not execute again	Repeat guard has not been reset.	Write command 0 to 40232, then issue the command again.
Calibration command has no effect	Trigger did not change to non-zero or was not reset after a previous command.	Set all parameters, change 40385 to 1, read 40386, then write 40385 back to 0.

Safety note: Calibration, zeroing, taring and output control can affect the weighing result and connected machinery. Apply access control, validate commands in the host application and ensure that all operations comply with the applicable metrological and machine-safety requirements.