Application Note

MicroScan Digital Interface - Modbus

Revision record:

Date	Description	Written by	Rev.
08 /12/2008	1st release	Itay Weichselbaum	1.00

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1. SCOPE

This document presents the digital communication interface of the **MicroScan** ultrasonic level meter. The document describes the layers of communication, from physical layer all the way up to ModBus application layer including description of ModBus internal RTU registers. The document is intended for users who wish to remotely read **MicroScan** measurements in an accurate digital manner and remotely control the equipment while avoiding the analog 4-20 communication link.

2. PHYSICAL LAYER PROPERTIES FOR A PC COM PORT

Baud rate:	9600 or 19200 bps
Data bits:	8 bits
Parity:	None
Stop bits:	One bit
Flow control:	None
Serial data standard:	RS232 or RS485

Notes:

1. Baud rate is user-selectable using an on-board jumper.

2. Serial data standard is a factory setup and must be decided by the customer at purchase time.

3. GENERAL DESCRIPTION

The new digital communication interface for the 2-wire **MicroScan** level meter expands the existing user interfaces and communication capabilities of the equipment.

MicroScan supports the following user and communication interfaces:

- External setup unit with LCD and keypad for manual configuration (MSU)
- External remote unit with LCD and keypad for display and configuration (EMSU)
- Optional built-in LCD for visual information
- Analog 4-20mA current loop for level measurement indications
- New internal digital interface card (DIC) supporting RS232 or RS485 serial data
- New ModBus RTU communication protocol above the serial data interface

The new interface allows the user to remotely configure and accurately monitor **MicroScan** from a PC.

Note: *A* **MicroScan** *equipped with the new digital communication interface is a 4-wire device.*

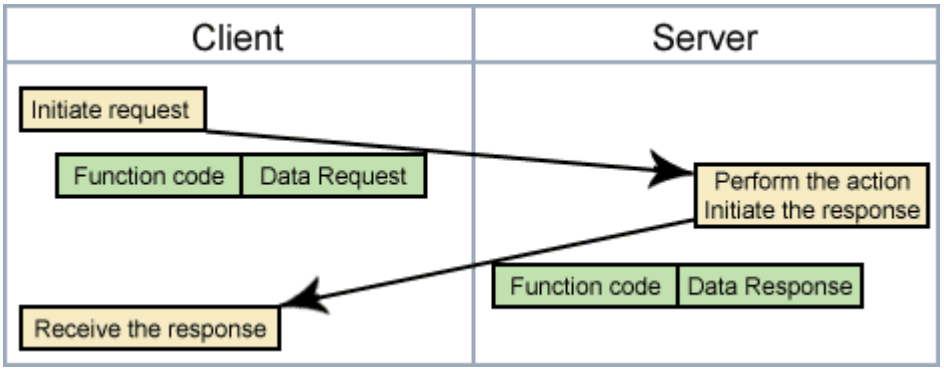
4. MICROSCAN MODBUS PROTOCOL

4.1 General overview

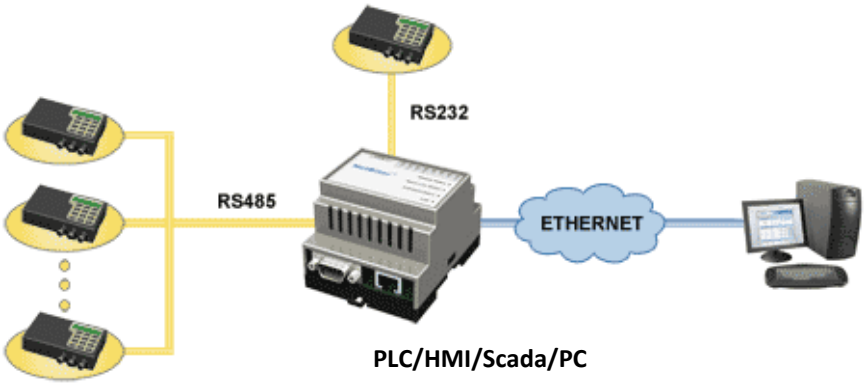
Modbus is a protocol developed by Modicon in 1979 and used to establish master-slave or client-server communications between intelligent devices. Modbus is a de facto standard, open and widely used in industrial manufacturing environment. Modbus enables the transfer of discrete, analog or register data between devices. The original Modbus interface ran on top of RS232, but later Modbus implementations implemented RS485 because it allowed longer distances, higher speeds and the possibility of multi-drop networks.

Modbus is an application layer positioned at level 7 of the OSI model. The protocol defines a data structure based on a request/reply messaging and offers services specified by function codes. Function codes are elements of Modbus request/reply Protocol Data Units (PDU). The data unit is created by the client that initiates a transaction. The function indicates to the server what kind of action to perform. The function code field of a data unit is coded in one byte. Valid codes are in the range of 1 ... 255 decimal (128 – 255 are reserved for exception responses).

Messaging chart



4.2 Modbus topology



Modbus topology may be:

- Multidrop connection – RS485
- Pear-to-Pear – RS232.

4.3 Modbus framing

Modbus messages are not sent in a plain format. They provide the receivers an easy way to detect the beginning and end of a message.

The entire message frame must be transmitted as a continuous stream. If a silent interval of more than 1.5 character times occurs before completion of the frame, the receiving device flushes the incomplete message and assumes that the next byte will be the address field of a new message.

Similarly, a new message should not begin earlier than 3.5 character times following a previous message. Otherwise, the receiving device will consider the new message as a continuation of the previous message. This will set an error, as the value in the final CRC field will not be valid for the combined messages.

A typical message frame is shown below:

Read Command: Slave address #2, 40002 register, 1 word response.

Client (master) request:

		Address of 1st word		Number of words		CRC16	
Slave address	Function code	High byte	Low byte	High byte	Low byte	CRCL	CRCH
02	03	00	01	00	01	D5	F9

Server (slave) response:

		Number of bytes of data	Data		CRC16	
Slave address	Function code	One Byte	High byte	Low byte	CRCL	CRCH
02	03	02	13	88		

Notes:

1. Slave response data bytes must be divided by 1000 in order to have a correct value.

2. If slave response number of data is greater than 2, data is structured so that higher byte comes before lower byte.

3. MicroScan Modbus processor allows the reading of one parameter at a time.

Another example

Write Command: Slave address #2, 40002 register, Write 1 word.

Master request:

		Address of 1st word		Data to write		CRC16	
Slave address	Function code	High byte	Low byte	High byte	Low byte	CRCL	CRCH
02	06	00	01	13	88	D5	5C

Slave response:

		Address of 1st word		Data to write		CRC16	
Slave address	Function code	High byte	Low byte	High byte	Low byte	CRCL	CRCH
02	06	00	01	13	88	D5	5C

Notes:

1. The slave should respond by echoing the message.

2. The master should multiply real data by 1000 to have a correct data structure. For example, 5meters should be represented by 5000 of 0x1388.

*3. MicroScan Modbus processor allows writing **one** parameter at a time.*

If the slave did not accept a new set point value, say because of a set point limit or out range the response would be:

Slave Modbus error response:

		Exception #	CRC16	
Slave address	Function code	Error value	CRCL	CRCH
02	86	03	F2	61

4.4 Modbus error messages

If an instrument receives a message which contains a corrupted character (parity check fail, framing error. etc.) or if the CRC16 check fails, the instrument ignores the message. If the message is otherwise syntactically flawed (e.g. the byte count or word count is incorrect) the instrument will also not reply.

If the instrument receives a syntactically correct message which contains an illegal value, it will send an exception response, consisting of five bytes as follows:

		Exception #	CRC16	
Slave address	Function code	Error value	CRCL	CRCH
1 Byte	1 Byte	1 Byte	1 Byte	1 Byte

The Function Code field consists of the function number contained in the message which caused the error, with its most significant bit set (i.e. function 6 becomes x86), and the Exception Number is one of the codes contained in the table below.

Error Codes		
Code	Name	Cause
1	Illegal function	Function number out of range
2	Illegal Data Address	Parameter ID out of range or not supported
3	Illegal Data Value	Attempt to write invalid data or not enough data words
4	Device Failure	Keypad or LCD interface failure
5	Acknowledge	N/A
6	Busy	N/A
7	Negative Acknowledge	N/A

4.5 Register summary

Register number	Description	Read	Write	Command
40001	Reset device			√
40002	Tank height	√	√	
40003	Scan distance - search			√
40004	4mA	√	√	
40005	20mA	√	√	
40006	Dynamic mode	√	√	
40007				
40008	LCD indication	√	√	
40009	Gas fact (extended range only)	√	√	
40010	Clear to default			√
40020	Device units	√	√	
40023	Device range	√	√	
40024	Application type	√	√	
40025	SBD	√	√	
40026	Get measurement	√		√
40027	4mA indication	√	√	
40028	Next button			√
40029	Enter button			√
40030	Escape button			√
40032	Clear scan distance interferences			√
40033	Read scan distance interferences	√		
40034	SW version	√		
40035	Device status	√		
40036	Keypad status	√		
40037	LCD Status	√		

Detailed Register information is provided in Appendix A.

Appendix A - Modbus registers

40001 - Initialize MicroScan (read only)

Register 40001 enables the user to perform reset command that refreshes the MicroScan measurement reading, similar to power shutdown effect. For further information, refer to the MicroScan UM, page 21.

Client Modbus request (slave ID #1) –

01	03	00 00	00 01	84 0A
ID	Modbus command	Register address	num of data	CRC16

Slave response –

- Operation succeed – 0x1
- Operation failed – Exception Error 4.

Slave response (slave ID #1) –

01	03	02	00 01	2 bytes
ID	Modbus command	num of data bytes	Data bytes	CRC16

Slave Modbus Error respond (slave ID #1) –

01	83	04	2 bytes
ID	Modbus command	Error value	CRC16

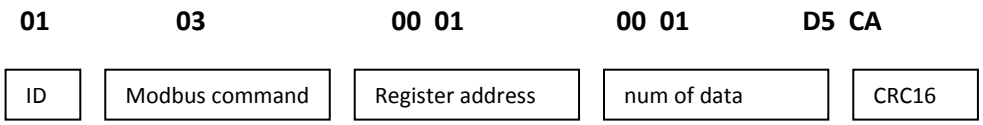
40002 – Tank Height (read\write)

40002 register enables the user to read\change the tank height value, measurement range of the MicroScan. For further information, refer to the MicroScan UM, page 22.

- Tank height value should not exceed the maximum range of the specific MicroScan model.
- Read operation – Data value should be divided by 1000 to have the real value.
- Write operation – Data to Write value should be multiplied by 1000 in order to correlate it to the Modbus framing method.

Read command –

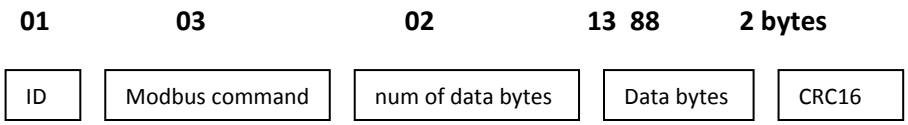
Client Modbus request (slave ID #1) –



Slave respond –

- Operation succeed – 2 data bytes (divide result by 1000 in order to have the value).
- Operation failed – Error 4.

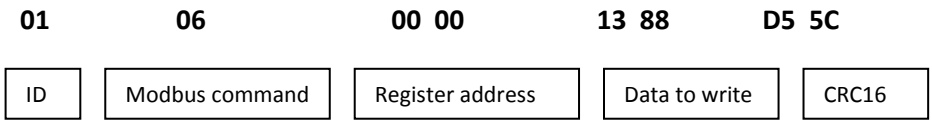
Slave Modbus respond (slave ID #1, Tank height = 5000 (5m)) –



- For Error sequence, refer to paragraph 4.3

Write command –

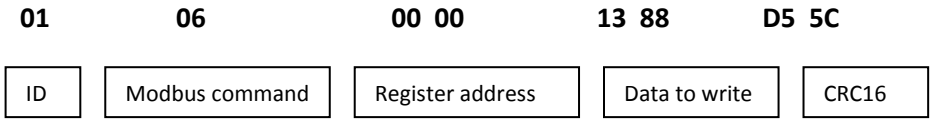
Client Modbus write request (slave ID #1, Data to write = 5000 (5m)) –



Slave respond –

- Operation succeed – sends back the master's stream.
- Operation failed – Error 4.
- Wrong value – Error 3.

Slave Modbus write respond (slave ID #1) –



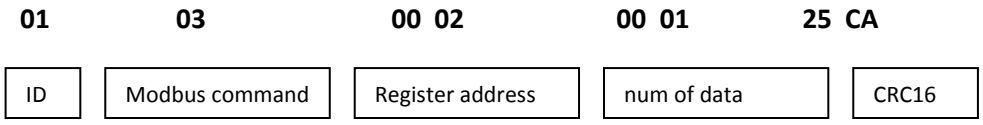
- For Error sequence, refer to paragraph 4.3

40003 – Scan distance (Read only)

Scan distance register enables the user to locate and store up to 7 interfering signals (false echoes) to avoid having obstructions. The MicroScan sends back an interference value, if this interference is the actual media's distance from the sensor, the user should send enter button request (40029 register) to approve the interfere as the actual measurement, otherwise the user should send next button request (40028 register) in order to continue searching. For further information, refer to the MicroScan UM, page 24.

- Next interference value will be sent to register 40028 (next button register) and so on.

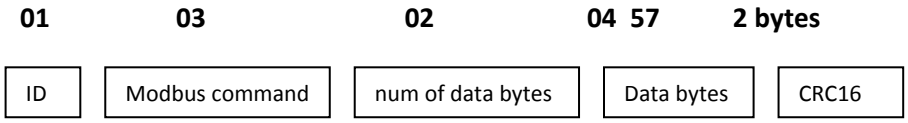
Client Modbus request (slave ID #1) –



Slave respond –

- Operation succeeds – 2 data bytes (divide result by 1000 in order to have the value).
- Operation failed – Error 4, register 40083.
- Received data should be divided by 1000 to have the real interference value.

Slave Modbus respond (slave ID #1, interfere value = 1111 (1.111m)) –



- For Error sequence, refer to paragraph 4.3

40004 – 4mA (Read\Write)

40004 register (4mA) enables the user to read\change the 4mA mark for remote monitoring. For further information, refer to the MicroScan UM, page 27.

- 4mA value shouldn't exceed the maximum range of the specific MicroScan model.
- Read operation – Data value should be divided by 1000 to have the real value.
- Write operation – Data to write value should be multiplied by 1000 in order to correlate it to the Modbus framing method.

Read command –

Client Modbus request (slave ID #1) –

01	03	00 03	00 01	74 0A
ID	Modbus command	Register address	num of data	CRC16

Slave respond –

- Operation succeeds – 2 data bytes (divide result by 1000 in order for 4mA value).
- Operation failed – Error 4.

Slave Modbus respond (slave ID #1, 4mA = 0 (0m)) –

01	03	02	00 00	2 bytes
ID	Modbus command	num of data bytes	Data bytes	CRC16

- For Error sequence, refer to paragraph 4.3

Write command –

Client Modbus write request (slave ID #1, Data to write = 50 (0.05m)) –

01	06	00 03	00 32	F8 1F
ID	Modbus command	Register address	Data to write	CRC16

Slave respond –

- Operation succeed – sends back the master's stream.
- Operation failed – Error 4.
- Wrong value – Error 3.

Slave Modbus write respond (slave ID #1) –

01	06	00 03	00 32	F8 1F
ID	Modbus command	Register address	Data to write	CRC16

- For Error sequence, refer to paragraph 4.

40005 – 20mA (Read\Write)

40005 register (20mA) enables the user to read\change the 20mA mark for remote monitoring.
For further information, refer to the MicroScan UM, page 30.

- 20mA value shouldn't exceed the maximum range of the specific MicroScan model.
- Read operation – Data value should be divided by 1000 to have the real value.
- Write operation – Data to Write value should be multiplied by 1000 in order to correlate it to the Modbus framing method.

Read command –

Client Modbus request (slave ID #1) –

01	**03**	**00 04**	**00 01**	**C5 CB**
ID	Modbus command	Register address	num of data	CRC16

Slave respond –

- Operation succeeds – 2 data bytes (divide result by 1000 in order to have the 4mA value).
- Operation failed – Error 4.

Slave Modbus respond (slave ID #1, 5mA =5000 (5m)) –

01	**03**	**02**	**13 88**	**2 bytes**
ID	Modbus command	num of data bytes	Data bytes	CRC16

- For Error sequence, refer to paragraph 4.3

Write command –

Client Modbus write request (slave ID #1, Data to write = 5000 (5m)) –

01	**06**	**00 04**	**13 88**	**F8 1F**
ID	Modbus command	Register address	Data to write	CRC16

Slave respond –

- Operation succeed – sends back the master's stream.
- Operation failed – Error 4.
- Wrong value – Error 3.

Slave Modbus write respond (slave ID #1) –

01	06	00 04	13 88	F8 1F
ID	Modbus command	Register address	Data to write	CRC16

- For Error sequence, refer to paragraph 4.3.

40006 – Dynamic mode (Read\Write)

40006 register enables the user to read\change the configured speed and accuracy level. For further information, refer to the MicroScan UM, page 32.

Dynamic modes:

1. 0 – SE0 (0.8m\minute).
2. 1 – SE1 (1.5m\minute).
3. 2 – SE2 (2m\minute).

Read command –

Client Modbus request (slave ID #1) –

01	03	00 05	00 01	94 0B
ID	Modbus command	Register address	num of data	CRC16

Slave respond –

- Operation succeed – 2 data bytes, LSB contains the result:
  1. 0 – SE0 (0.8m\minute).
  2. 1 – SE1 (1.5m\minute).
  3. 2 – SE2 (2m\minute).
- Operation failed – Error 4.

Slave Modbus respond (slave ID #1, SE1) –

01	03	02	00 01	2 bytes
ID	Modbus command	num of data bytes	Data bytes	CRC16

- For Error sequence, refer to paragraph 4.3

Write command –

Client Modbus write request (slave ID #1, SE1) –

01	06	00 05	00 01	58 0B
ID	Modbus command	Register address	Data to write	CRC16

Slave respond –

- Operation succeed – sends back the master's stream.
- Operation failed – Error 4.
- Wrong value – Error 3.

Slave Modbus write respond (slave ID #1) –

01	06	00 05	00 01	58 0B
ID	Modbus command	Register address	Data to write	CRC16

- For Error sequence, refer to paragraph 4.3.

40008 – Dynamic mode (Read\Write)

40008 register enables the user to view\change either distance or level measurement on the LCD display.
For further information, refer to the MicroScan UM, page 35.

Read command –

Client Modbus request (slave ID #1) –

01	03	00 07	00 01	35 CB
ID	Modbus command	Register address	num of data	CRC16

Slave respond –

- Operation succeed – 2 data bytes, LSB contains the result:
    1. 0x64 – distance.
    2. 0x4C – Level.
- Operation failed – Error 4.

Slave Modbus respond (slave ID #1, Level) –

01	03	02	00 4C	2 bytes
ID	Modbus command	num of data bytes	Data bytes	CRC16

- For Error sequence, refer to paragraph 4.3

Write command –

Client Modbus write request (slave ID #1, distance) –

01	**06**	**00 07**	**00 64**	**39 E0**
ID	Modbus command	Register address	Data to write	CRC16

Slave respond –

- Operation succeed – sends back the master's stream.
- Operation failed – Error 4.
- Wrong value – Error 3.

Slave Modbus write respond (slave ID #1) –

01	**06**	**00 07**	**00 64**	**39 E0**
ID	Modbus command	Register address	Data to write	CRC16

- For Error sequence, refer to paragraph 4.3.

40009 – Gas factor (extended range MicroScan only, Read\Write)

40009 register enables the user to read\change the compensate value for sound velocity changes in different types of gasses.
For further information, refer to the MicroScan UM, page 35.

- Gas factor value shouldn't exceed the maximum range of the specific MicroScan model. ***
- Read operation – Data value should be divided by 1000 to have the real value.
- Write operation – Data to write value should be multiplied by 1000 in order to correlate it to the Modbus framing method.

Read command –

Client Modbus request (slave ID #1) –

01	**03**	**00 08**	**00 01**	**05 C8**
ID	Modbus command	Register address	num of data	CRC16

Slave respond –

- Operation succeeds – 2 data bytes (divide result by 1000 in order to have the 4mA value).
- Operation failed – Error 4.

Slave Modbus respond (slave ID #1, Level) –

01	**03**	**02**	**00 4C**	**2 bytes**
ID	Modbus command	num of data bytes	Data bytes	CRC16

- For Error sequence, refer to paragraph 4.3

Write command –

Client Modbus write request (slave ID #1, factor = 01.00 (100)) –

01	**06**	**00 08**	**00 64**	**09 E3**
ID	Modbus command	Register address	Data to write	CRC16

Slave respond –

- Operation succeeds – sends back the master's stream.
- Operation failed – Error 4.
- Wrong value – Error 3.

Slave Modbus write respond (slave ID #1) –

01	**06**	**00 08**	**00 64**	**09 E3**
ID	Modbus command	Register address	Data to write	CRC16

- For Error sequence, refer to paragraph 4.3.

40010 – Clear to default settings (Read only)

40010 register allows the user to clear all user-defined settings and revert to the default factory settings.
For further information, refer to the MicroScan UM, page 35.

Client Modbus request (slave ID #1) –

01	03	00 09	00 01	54 08
ID	Modbus command	Register address	num of data	CRC16

Slave respond –

- Operation succeed – 2 data bytes, LSB contains the result:
    1. 0 – Operation failed.
    2. 1 – Operation succeeds.
- Operation failed – Error 4

Slave Modbus respond (slave ID #1, succeed (1)) –

01	03	02	00 01	2 bytes
ID	Modbus command	num of data bytes	Data bytes	CRC16

Slave Modbus Error respond (slave ID #1) –

01	83	04	2 bytes
ID	Modbus command	Error value	CRC16

40020 – Units (m/ft) (Read\Write)

40020 register allows the user to read\change the device units (meter/feet).

Units:

1. 0x46 – Feet
2. 0x6D – meter.

Read command –

Client Modbus request (slave ID #1) –

01	03	00 13	00 01	75 CF
ID	Modbus command	Register address	num of data	CRC16

Slave respond –

- Operation succeed – 2 data bytes, LSB contains the result:
    3. 0x46 – Feet
    4. 0x6D – meter.
- Operation failed – Error 4, register 40100.

Slave Modbus respond (slave ID #1, meter) –

01	**03**	**02**	**00 6D**	**2 bytes**
ID	Modbus command	num of data bytes	Data bytes	CRC16

- For Error sequence, refer to paragraph 4.3

Write command –

Client Modbus write request (slave ID #1, unit = meter (6D)) –

01	**06**	**00 13**	**00 6D**	**B9 E2**
ID	Modbus command	Register address	Data to write	CRC16

Slave respond –

- Operation succeeds – sends back the master's stream.
- Operation failed – Error 4.
- Wrong value – Error 3.

Slave Modbus write respond (slave ID #1) –

01	**06**	**00 13**	**00 6D**	**B9 E2**
ID	Modbus command	Register address	Data to write	CRC16

- For Error sequence, refer to paragraph 4.3.

40023 – Range (extended range MicroScan only) (Read\Write)

40023 register allows the user to read\change the device range (short/Standard).

Ranges:

1. 0x53 – Standard
2. 0x72 – short.

Read command –

Client Modbus request (slave ID #1) –

01	**03**	**00 16**	**00 01**	**65 CE**
ID	Modbus command	Register address	num of data	CRC16

Slave respond –

- Operation succeed – 2 data bytes, LSB contains the result:
  3. 0x53 – Standard
  4. 0x72 – short.
- Operation failed – Error 4.

Slave Modbus respond (slave ID #1, short (0x72)) –

01	**03**	**02**	**00 72**	**2 bytes**
ID	Modbus command	num of data bytes	Data bytes	CRC16

- For Error sequence, refer to paragraph 4.3

Write command –

Client Modbus write request (slave ID #1, unit = short (72)) –

01	06	00 16	00 72	E8 2B
ID	Modbus command	Register address	Data to write	CRC16

Slave respond –

- Operation succeeds – sends back the master's stream.
- Operation failed – Error 4.
- Wrong value – Error 3.

Slave Modbus write respond (slave ID #1) –

01	06	00 16	00 72	E8 2B
ID	Modbus command	Register address	Data to write	CRC16

- For Error sequence, refer to paragraph 4.3.

40024 – Application type

40024 register allows the user to read\change the device application type (Liquid/Solid).

Application types:

1. 0x53 – Solid
2. 0x4C – Liquid.

Read command –

Client Modbus request (slave ID #1) –

01	03	00 17	00 01	34 0E
ID	Modbus command	Register address	num of data	CRC16

Slave respond –

- Operation succeed – 2 data bytes, LSB contains the result:

3. 0x53 – Solid
4. 0x4C – Liquid.

- Operation failed – Error 4.

Slave Modbus respond (slave ID #1, Liquid) –

01	03	02	00 4C	2 bytes
ID	Modbus command	num of data bytes	Data bytes	CRC16

- For Error sequence, refer to paragraph 4.3

Write command –

Client Modbus write request (slave ID #1, unit = Solid (0x53)) –

01	06	00 17	00 53	79 F3
ID	Modbus command	Register address	Data to write	CRC16

Slave respond –

- Operation succeed – 2 data bytes, LSB contains the result:
    5. 0x53 – Solid
    6. 0x4C – Liquid.
- Operation failed – Error 4.
- Wrong value – Error 3.

Slave Modbus write respond (slave ID #1) –

01	06	00 17	00 53	79 F3
ID	Modbus command	Register address	Data to write	CRC16

- For Error sequence, refer to paragraph 4.3.

40025 – SBD

40025 register allows the user to read/change the Shifting Blocking Distance value. For further information, refer to the MicroScan UM, page 38.

- SBD value shouldn't exceed 1.5 meters.
- Read operation – Data value should be divided by 1000 to have the real value.
- Write operation – Data to write value should be multiplied by 1000 in order to correlate it to the Modbus framing method.

Read command –

Client Modbus request (slave ID #1) –

01	**03**	**00 18**	**00 01**	**04 0D**
ID	Modbus command	Register address	num of data	CRC16

Slave respond –

- Operation succeeds – 2 data bytes (divide result by 1000 in order to have the value).
- Operation failed – Error 4.

Slave Modbus respond (slave ID #1, Tank height = 1500 (1.5m)) –

01	**03**	**02**	**05 DC**	**2 bytes**
ID	Modbus command	num of data bytes	Data bytes	CRC16

- For Error sequence, refer to paragraph 4.3

Write command –

Client Modbus write request (slave ID #1, Data to write = 0000 (0m)) –

01	**06**	**00 18**	**00 00**	**09 CD**
ID	Modbus command	Register address	Data to write	CRC16

Slave respond –

- Operation succeeds – sends back the master's stream.
- Operation failed – Error 4.
- Wrong value – Error 3.

Slave Modbus write respond (slave ID #1) –

01	06	00 18	00 00	09 CD
ID	Modbus command	Register address	Data to write	CRC16

- For Error sequence, refer to paragraph 4.3

40026 – Get measurement (Read only)

40026 register allows the user to read the current measurement.

Read command –

Client Modbus request (slave ID #1) –

01	03	00 19	00 01	55 CD
ID	Modbus command	Register address	num of data	CRC16

Slave respond –

- Operation succeeds – 2 data bytes (divide result by 1000 in order to have the value).
- Operation failed – Error 4.

Slave Modbus respond (slave ID #1, measurement value = 0500 (0.5m)) –

01	03	02	01 F4	84 0A
ID	Modbus command	num of data bytes	Data bytes	CRC16

- For Error sequence, refer to paragraph 4.3

40027 – 4-20mA indication

40027 register allows the user to read/change the 4-20mA current indication (Level/distance).

Indication types:

1. 0x4C – Level.
2. 0x6D - Distance

Read command –

Client Modbus request (slave ID #1) –

01	03	00 1A	00 01	A5 CD
ID	Modbus command	Register address	num of data	CRC16

Slave respond –

- Operation succeed – 2 data bytes, LSB contains the result:
    1. Level – 0x4C
    2. distance – 0x6D
- Operation failed – Error 4.

Slave Modbus respond (slave ID #1, Indication = Level (0x4C)) –

01	03	02	00 4C	2 bytes
ID	Modbus command	num of data bytes	Data bytes	CRC16

- For Error sequence, refer to paragraph 4.3

<u>Write command</u> –

Client Modbus write request (slave ID #1, Data to write = 0x4C (Level)) –

01	06	00 1A	00 4C	A9 F8
ID	Modbus command	Register address	Data to write	CRC16

Slave respond –

- Operation succeeds – sends back the master's stream.
- Operation failed – Error 4.
- Wrong value – Error 3.

Slave Modbus write respond (slave ID #1) –

01	06	00 1A	00 4C	A9 F8
ID	Modbus command	Register address	Data to write	CRC16

- For Error sequence, refer to paragraph 4.3

40028 – Next button (Command)

40028 register allows the user to press the next button.
Also, register 40028 used to enable scan distance interferences (see scan distance register, 40003).

Next command –

Client Modbus request (slave ID #1) –

01	**03**	**00 1B**	**00 01**	**F4 0D**
ID	Modbus command	Register address	num of data	CRC16

Slave respond –

- Operation succeed – 2 data bytes, LSB contains the result:
    1. 0 – failed
    2. 1 – succeed
- Operation failed – Error 4.

Slave Modbus respond (slave ID #1, operation succeed (1)) –

01	**03**	**02**	**00 01**	**2 bytes**
ID	Modbus command	num of data bytes	Data bytes	CRC16

- For Error sequence, refer to paragraph 4.3

Scan distance Next command –

User can approve interfere as a false measurement using the next command.

- **Refer to scan distance mechanism at MicroScan UM, page 24.**

Client Modbus scan distance ent request (slave ID #1) –

01	**03**	**02**	**00 01**	**84 0A**
ID	Modbus command	num of data bytes	Data bytes	CRC16

Slave respond –

- Operation succeeds – 2 data bytes (divide result by 1000 in order to have the value).
- Operation failed – Error 4.

Slave Modbus write respond (slave ID #1, interfere value = 0.444m (444)) –

01	**03**	**02**	**01 BC**	**2 bytes**
ID	Modbus command	num of data bytes	Data bytes	CRC16

- For Error sequence, refer to paragraph 4.3
- After user presses next, MicroScan continues to scan for interferences.

40029 – Enter button (Command type)

40029 register allows the user to press the enter button.
Also, enter button is used to approve interfere as the real measurement when scan distance function is working. Pressing enter, saves the interfere as the correct measurement.

Enter command –

Client Modbus request (slave ID #1) –

01	**03**	**00 1C**	**00 01**	**45 CC**
ID	Modbus command	Register address	num of data	CRC16

Slave respond –

- Operation succeed – 2 data bytes, LSB contains the result:
  1. 0 – failed
  2. 1 – succeed
- Operation failed – Error 4.

Slave Modbus respond (slave ID #1, operation succeed (1)) –

01	**03**	**02**	**00 01**	**2 bytes**
ID	Modbus command	num of data bytes	Data bytes	CRC16

- For Error sequence, refer to paragraph 4.3

Scan distance Enter command –

User can approve interfere as the real measurement using the enter command.

- **Refer to scan distance mechanism at MicroScan UM, page 24.**
- **Slave respond is same as regular enter button command respond.**

40030 – Escape button (Command type)

40030 register allows the user to press the escape button.

Enter command –

Client Modbus request (slave ID #1) –

01	03	00 1D	00 01	14 0C
ID	Modbus command	Register address	num of data	CRC16

Slave respond –

- Operation succeed – 2 data bytes, LSB contains the result:
    1. 0 – failed
    2. 1 – succeed
- Operation failed – Error 4.

Slave Modbus respond (slave ID #1, operation succeed (1)) –

01	03	02	00 01	2 bytes
ID	Modbus command	num of data bytes	Data bytes	CRC16

- For Error sequence, refer to paragraph 4.3

40032 – Clear Scan distance (Command type)

40032 register clears the scan distance interferences from the MicroScan's memory.
For further information, refer to the MicroScan UM, page 24.

Client Modbus request (slave ID #1) –

01	03	00 1F	00 01	B5 CC
ID	Modbus command	Register address	num of data	CRC16

Slave respond –

- Operation succeed – 2 data bytes, LSB contains the result:
    1. 0 – failed
    2. 1 – succeed
- Operation failed – Error 4.

Slave Modbus respond (slave ID #1, operation succeed (1)) –

01	03	02	00 01	2 bytes
ID	Modbus command	num of data bytes	Data bytes	CRC16

- For Error sequence, refer to paragraph 4.3

40033 – Read Scan distance interferences (Read only)

40033 register allows the user to read the saved scan distance interferences from the DIC memory. MicroScan can save up to 7 interferences

Client Modbus Read scan distance request (slave ID #1) –

01	03	00 20	00 01	85 C0
ID	Modbus command	Register address	num of data	CRC16

Slave respond –

- Read Scan distance operation –
    1. Between 2 to 14 bytes of data, 2 bytes for each interfering (divide result by 1000 in order to have the value).
    2. 0 – No interfering saved.

Slave Modbus respond (slave ID #1, one interfere, 1.000m (1000)) –

01	03	02	03 E8	2 bytes
ID	Modbus command	num of data bytes	Data bytes	CRC16

40034 – SW version (Read only)

40034 register allows the user to read the SW version of the digital card**.**

Client Modbus SW version request (slave ID #1) –

01	03	00 21	00 01	D4 00
ID	Modbus command	Register address	num of data	CRC16

Slave Modbus respond (slave ID #1, SW version = 0100 (0x64)) –

01	03	02	00 64	2 bytes
ID	Modbus command	num of data bytes	Data bytes	CRC16

Slave respond –

- Operation succeeds – 2 data bytes (divide result by 1000 in order to have the value).

40035 – Device status (Read only)

40035 register allows the user analyze the DIC status (LCD, Keypad and memory status)**.**

Status indication –

- 0 – OK.
- 1 – LCD & Keypad Error.
- 2 – LCD Error.
- 3 – Keypad error.

Client Modbus status request (slave ID #1) –

01	03	00 22	00 01	24 00
ID	Modbus command	Register address	num of data	CRC16

Slave Modbus respond (slave ID #1, status = 0 (OK)) –

01	03	02	00 00	2 bytes
ID	Modbus command	num of data bytes	Data bytes	CRC16

<u>40036</u> – Keypad status (Read only)

40036 register allows the user analyze the DIC electrical keypad status**.**

Keypad status indication –

- 0 – OK.
- 1 –Error.

Client Modbus Keypad status request (slave ID #1) –

01	03	00 23	00 01	75 C0
ID	Modbus command	Register address	num of data	CRC16

Slave Modbus respond (slave ID #1, status = 0 (OK)) –

01	03	02	00 00	2 bytes
ID	Modbus command	num of data bytes	Data bytes	CRC16

<u>40037</u> – LCD status (Read only)

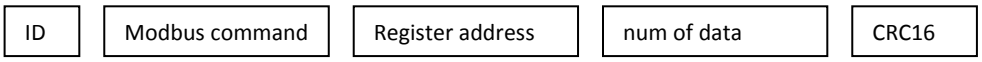
40037 register allows the user analyze the DIC LCD interface status**.**

LCD status indication –

- 0 – OK.
- 1 –Error.

Client Modbus LCD status request (slave ID #1) –

01	03	00 24	00 01	C4 01



Slave Modbus respond (slave ID #1, status = 0 (OK)) –

01 03 02 00 00 2 bytes