Thermo
SCIENTIFIC

Ramsey
MINI CK101
Weight Integrator

MODBUS - TCP
Manual

MINI CK101
Part No.: Modbus Tcp

DOCUMENT HISTORY

DATE	REV	REASON FOR CHANGE	AUTHOR
January, 2009	X1	Preliminary	Mazzoni Massimo
April, 2009	X2	Issue	Mazzoni Massimo

File: \\ 101_ModbusTcp-X2

Actual Software Release: 86.00.00.01

INDEX

About this manual 4
Bibliography 4
1. MODBUS-TCP OVERVIEW 5
1.1 Introduction to the MODBUS-TCP 5
1.2 The MODBUS-TCP 5
1.3 Client – Server model 6
1.4 Abbreviations 7
2 IMPLEMENTATION ON THE MINICK 101 8
2.1 Protocol description. 8
2.1.1 General communication architecture 8
General MODBUS Frame 9
2.1.2 MODBUS On TCP/IP Application Data Unit 9
2.1.3 MBAP header description 10
3 REGISTERS LIST 12
3.1 Description of the variables 12
3.2 List of registers 13
3.3 Description of Registers 24
3.3.1 Status 25
3.3.2 Dynamic Values 31
3.3.3 Display Data 32
3.3.4 Scale Data 35
3.3.5 Calibration Data 36
3.3.6 Diagnostic data 38
3.3.7 I/O Data 39
3.3.8 Alarms 42
3.3.9 Ethernet Settings 43
3.3.10 Serial Settings 44
3.3.11 Profibus Settings 46
3.3.12 Load Out (Batch) 47
4 QUERY, RESPONSE MESSAGES AND EXAMPLE 49
4.1 Read Operation Example (Function 03) 49
4.2 Write Operation Example 51
APPENDIX A 53

About this manual

The *Modbus-Tcp protocol* manual consists of three parts.

Chapter 1, Brief overview of the MODBUS-TCP protocol.

Chapter 2, Explains how MODBUS-TCP protocol has been implemented in the Ramsey Mini CK instruments. The information contained in this section should be intent as general information, they are valid for all the MINI CK Series models.

Chapter 3, Detailed description of the data that can be transmitted and received to and from the instrument. This part is specific for the instrument model.

Bibliography

- Modbus messaging on TCP/IP implementation guide V1.0b

1. MODBUS-TCP OVERVIEW

1.1 Introduction to the MODBUS-TCP

MODBUS® TCP/IP is an Internet protocol. The fact that TCP/IP is the transport protocol of the Internet automatically means that MODBUS® TCP/IP can be used over the Internet! Among other things it was designed to reach this goal, and as part of this goal the MODBUS® protocol specification has been submitted to the Internet Engineering Task Force (IETF). In practical terms, this means that a MODBUS® TCP/IP device installed in Europe can be addressed over the Internet from the USA from anywhere else in the world.
The implications for a vendor of equipment or an end-user are endless.

• Performing maintenance and repair on remote devices from the office using a PC and browser reduce support costs and improve customer service.

• Logging onto a plant's control system from home allows the maintenance engineer to maximize his plant's uptime and reduce the number of times that he is called out from home.

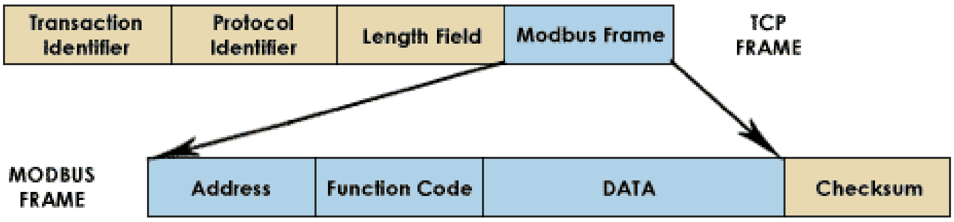
• Managing geographically distributed systems becomes easy using commercially available internet/intranet technologies.

MODBUS® TCP/IP has became an industry de facto standard because of its openness, simplicity, low cost development, and minimum hardware required to support it.
At this moment there are more than 200 MODBUS® TCP/IP devices available in the market. It is used to exchange information between devices, monitor and program them. It is also used to manage distributed I/Os, being the preferred protocol by the manufacturers of this type of devices.

Combining a versatile, scaleable, and ubiquitous physical network (Ethernet) with a universal networking standard (TCP/IP) and a vendor-neutral data representation (MODBUS®) gives a truly open, accessible network for exchange of process data

1.2 The MODBUS-TCP

Modbus/TCP basically embeds a Modbus frame into a TCP frame in a simple manner. This is a connection-oriented transaction which means every query expects a response.
This query/response technique fits well with the master/slave nature of Modbus, adding to the deterministic advantage that Switched Ethernet offers industrial users. The use of OPEN Modbus within the TCP frame provides a totally scaleable solution from ten nodes to ten thousand nodes without the risk of compromise that other multicast techniques would give.
The following figure shows a **modbus tcp** message enclosed in the TCP message :



Performance from a MODBUS TCP/IP system

The performance basically depends on the network and the hardware. If you are running MODBUS® TCP/IP over the Internet, you won't get better than typical Internet response times. However, for communicating for debug and maintenance purposes, this may be perfectly adequate.
For a high-performance Intranet with high-speed Ethernet switches to guarantee performance, the situation is completely different.
In theory MODBUS® TCP/IP carries data at up to 250/(250+70+70) or about 60% efficiency when transferring registers in bulk, and since 10 Base T Ethernet carries about 1.25 Mbytes/sec raw, the theoretical throughput is:
1.25M / 2 * 60% = 360000 registers per second and the 100 Base T speed is 10 x greater.
This assumes that you are using devices that can service Ethernet as fast as bandwidth is available.

1.3 Client – Server model

The MODBUS messaging service provides a Client/Server communication between devices connected on an Ethernet TCP/IP network.
This client / server model is based on four type of messages:

- **MODBUS Request,**
- **MODBUS Confirmation,**
- **MODBUS Indication,**
- **MODBUS Response**

A MODBUS Request is the message sent on the network by the Client to initiate a transaction,
A MODBUS Indication is the Request message received on the Server side,
A MODBUS Response is the Response message sent by the Server,
A MODBUS Confirmation is the Response Message received on the Client side

The MODBUS messaging services (Client / Server Model) are used for real time information exchange:

- between two device applications,
- between device application and other device,
- between HMI/SCADA applications and devices,
- between a PC and a device program providing on line services.

1.4 Abbreviations

ADU Application Data Unit
IETF Internet Engineering Task Force
IP Internet Protocol
MAC Medium Access Control
MB MODBUS
MBAP MODBUS Application Protocol
PDU Protocol Data Unit
PLC Programmable Logic Controller
TCP Transport Control Protocol
BSD Berkeley Software Distribution
MSL Maximum Segment Lifetime

2 IMPLEMENTATION ON THE MINICK 101

2.1 *Protocol description.*

2.1.1 General communication architecture

A communicating system over MODBUS TCP/IP may include different types of device:
• A MODBUS TCP/IP Client and Server devices connected to a TCP/IP network
• The Interconnection devices like bridge, router or gateway for interconnection between the TCP/IP network and a serial line sub-network which permit connections of MODBUS Serial line Client and Server end devices.

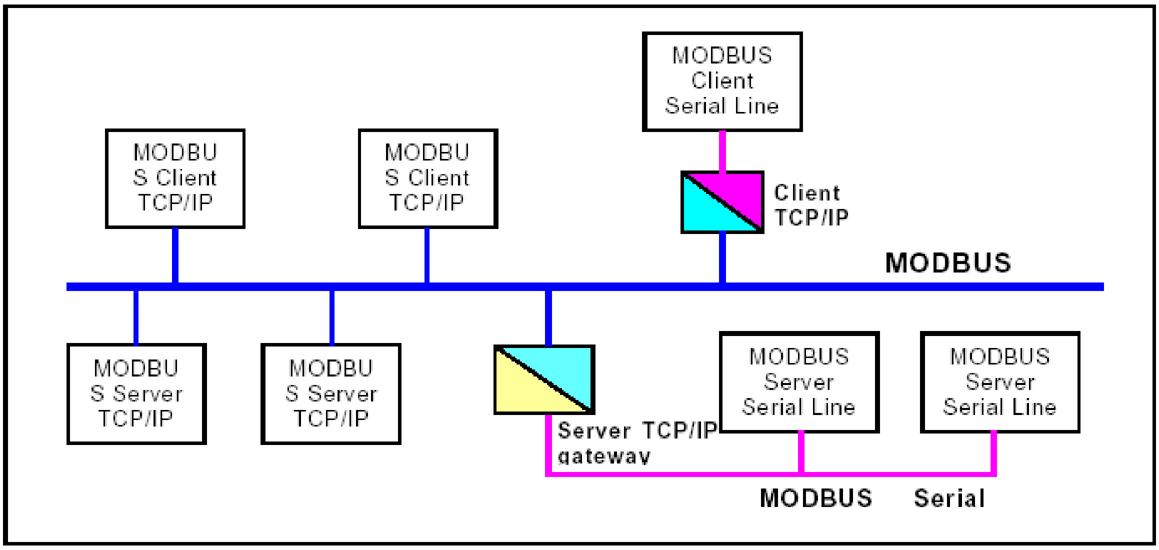
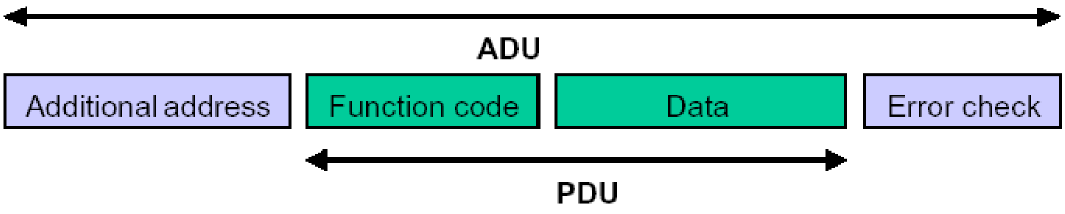


Figure 1: MODBUS TCP/IP communication architecture

The MODBUS protocol defines a **simple Protocol Data Unit (PDU)** independent of the underlying communication layers. The mapping of MODBUS protocol on specific buses or networks can introduce some additional fields on the **Application Data Unit (ADU)**.

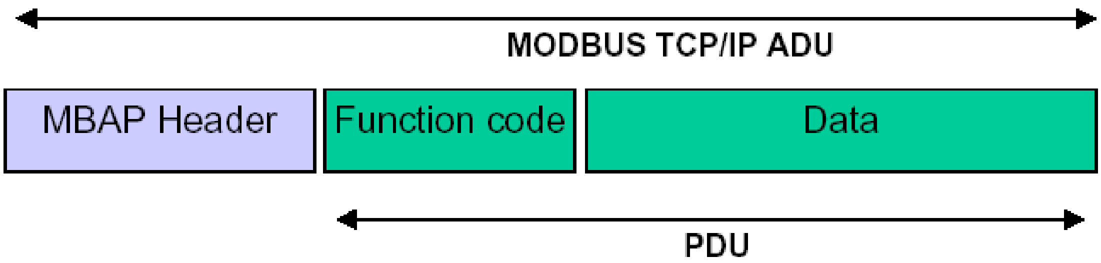


General MODBUS Frame

The client that initiates a MODBUS transaction builds the MODBUS Application Data Unit. The function code indicates to the server which kind of action to perform.

2.1.2 MODBUS On TCP/IP Application Data Unit

This section describes the encapsulation of a MODBUS request or response when it is carried on a MODBUS TCP/IP network.



Modbus request/response over TCP/IP

A dedicated header is used on TCP/IP to identify the MODBUS Application Data Unit. It

is called the MBAP header (MODBUS Application Protocol header).
This header provides some differences compared to the MODBUS RTU application data unit used on serial line:
The MODBUS 'slave address' field usually used on MODBUS Serial Line is replaced by a single byte 'Unit Identifier' within the MBAP Header. The 'Unit Identifier' is used to communicate via devices such as bridges, routers and gateways that use a single IP address to support multiple independent MODBUS end units.
All MODBUS requests and responses are designed in such a way that the recipient can verify that a message is finished. For function codes where the MODBUS PDU has a fixed length, the function code alone is sufficient. For function codes carrying a variable amount of data in the request or response, the data field includes a byte count.
When MODBUS is carried over TCP, additional length information is carried in the MBAP header to allow the recipient to recognize message boundaries even if the message has been split into multiple packets for transmission. The existence of explicit and implicit length rules, and use of a CRC-32 error check code (on Ethernet) results in an infinitesimal chance of undetected corruption to a request or response message.

2.1.3 MBAP header description

The MBAP Header contains the following fields:

Fields	Length	Description -	Client	Server
Transaction Identifier	2 Bytes	Identification of a MODBUS Request / Response transaction.	Initialized by the client	Recopied by the server from the received request
Protocol Identifier	2 Bytes	0 = MODBUS protocol	Initialized by the client	Recopied by the server from the received request
Length	2 Bytes	Number of following bytes	Initialized by the client (request)	Initialized by the server (Response)
Unit Identifier	1 Byte	Identification of a remote slave connected on a serial line or on other buses.	Initialized by the client	Recopied by the server from the received request

The header is 7 bytes long:

- **Transaction Identifier -** It is used for transaction pairing, the MODBUS server copies in the response the transaction identifier of the request.
- **Protocol Identifier** – It is used for intra-system multiplexing. The MODBUS protocol is identified by the value 0.
- **Length -** The length field is a byte count of the following fields, including the Unit Identifier and data fields.
- **Unit Identifier** – This field is used for intra-system routing purpose. It is typically used to communicate to a MODBUS+ or a MODBUS serial line slave through a gateway between an Ethernet TCP-IP network and a MODBUS serial line. This field is set by the MODBUS Client in the request and must be returned with the same value in the response by the server.

All MODBUS/TCP ADU are sent via TCP to registered port 502.

3 REGISTERS LIST

3.1 Description of the variables

The Table 1 of the next pages, lists the variables accessible by the Master specifically for the **MINI CK 101 Integrator**.

It is necessary at this point make a distinction between register and variables.
A *register* is the basic unit of the data at which the Master can access. The groups are structured in registers, they are numbered and the identification number is used by the Master to identify the portion of a group to read or write. Their dimension is always one word.
A *variable* is the format of storing of the data in the instrument memory. Its dimension can change depending by the variable type, we can have:

INTEGER variable	An integer is a variable of 1 word (1 register). It contains INTEGER values in the ranges 0 to 65535 or +32767 to -32768. The integer variables can be structured in array of integers with various dimensions.
FLOAT variable	A float is a variable of two words (2 register). It contains REAL values in the single precision IEEE format (See Appendix A at the end of this document). The single precision format can represent values in the range $3.4*10^{+38}$ to $1.18*10^{-38}$
LONG variable	A long is a variable of two words (2 register). It contains INTEGER values in the ranges 0 to 4294967295 or +2147483647 to -2147483648. The integer variables can be structured in array of integers with various dimensions.

NOTE
A lot of real values are displayed on the instrument with a number of decimals that depends by the selected division. For what regards the communication, instrument registers always contain the value with all the decimals.

For example:
Net weight Displayed value: 10.2
Sent value: 10.179982

LEGEND:

Register	Conventional name
Type	Can be: RO The register can be read but can not be written. It will be inserted only in the read groups. RW The register can be read or written. It will be found either in the read or in the write groups. WO The register can only be written. It will be inserted only in the read groups.
Low limit	Minimum acceptable value for the variable. Lower values are considered as errors.
High limit	Maximum acceptable value for the variable. Higher values are considered as errors.
Refresh t.	Time between two updates of the variable in the instrument's memory.
format	Can be: char , integer, float or double
Address (word)	Number of word (decimal) in the mapping, at which the register can be found.
Note	Comments and/or special info on use.

3.2 List of registers

Register	Type	Low Limit	High Limit	Refresh Time [ms]	Format	Address (word)	Note
Simulation Key	WO	(**)	(**)	-	Integer	0	
Write flag	RO	0	(*)	-	Integer	1	
DISPLAY DATA							
Display (1)	RO	-	-	200	Integer	2	
Display (2)	RO	-	-	200	Integer	3	
Display (3)	RO	-	-	200	Integer	4	
Display (4)	RO	-	-	200	Integer	5	
Display (5)	RO	-	-	200	Integer	6	
Display (6)	RO	-	-	200	Integer	7	
Display (7)	RO	-	-	200	Integer	8	
Display (8)	RO	-	-	200	Integer	9	
Display (9)	RO	-	-	200	Integer	10	
Display (10)	RO	-	-	200	Integer	11	
Display (11)	RO	-	-	200	Integer	12	
Display (12)	RO	-	-	200	Integer	13	
Display (13)	RO	-	-	200	Integer	14	
Display (14)	RO	-	-	200	Integer	15	
Display (15)	RO	-	-	200	Integer	16	
Display (16)	RO	-	-	200	Integer	17	
Display (17)	RO	-	-	200	Integer	18	
Display (18)	RO	-	-	200	Integer	19	
Display (19)	RO	-	-	200	Integer	20	

(*) Max limit is the number of digital inputs, it depends by the hardware configuration of the instrument.

(**) All the values are accepted but only a specific set of codes are interpreted as keys. See description of the variable.

Register	Type	Low Limit	High Limit	Refresh Time [ms]	Format	Address (word)	Note
Display (20)	RO	-	-	200	Integer	21	
Display (21)	RO	-	-	200	Integer	22	
Display (22)	RO	-	-	200	Integer	23	
Display (23)	RO	-	-	200	Integer	24	
Display (24)	RO	-	-	200	Integer	25	
Display (25)	RO	-	-	200	Integer	26	
Display (26)	RO	-	-	200	Integer	27	
Display (27)	RO	-	-	200	Integer	28	
Display (28)	RO	-	-	200	Integer	29	
Display (29)	RO	-	-	200	Integer	30	
Display (30)	RO	-	-	200	Integer	31	
Display (31)	RO	-	-	200	Integer	32	
Display (32)	RO	-	-	200	Integer	33	
Display (33)	RO	-	-	200	Integer	34	
Display (34)	RO	-	-	200	Integer	35	
Display (35)	RO	-	-	200	Integer	36	
Display (36)	RO	-	-	200	Integer	37	
Display (37)	RO	-	-	200	Integer	38	
Display (38)	RO	-	-	200	Integer	39	
Display (39)	RO	-	-	200	Integer	40	
Display (40)	RO	-	-	200	Integer	41	
STATUS AND DIAGNOSTIC DATA							
Panel Leds	RO	-	-	200	Integer	42	
Status (1)	RO	-	-	-	Integer	43	
Status (2)	RO	-	-	-	Integer	44	
Alarms (1)	RO	-	-	100	Integer	45	
Alarms (2)	RO	-	-	100	Integer	46	

Register	Type	Low Limit	High Limit	Refresh Time [ms]	Format	Address (word)	Note
Alarms (3)	RO	-	-	100	Integer	47	
In / Out image	RO	-	-	100	Integer	48	
Commands	RW	0	0Xffff	100	Integer	49	
Virtual Inputs Image	RW	0	0xffff	100	Integer	50	
Virtual Outputs Image	RO	-	-	100	Integer	51	
DYNAMIC DATA							
Batch Counter	RO	-	-	200	Integer	54	
Batch Set	RW	0	10000	200	Float	55	
Belt Rate	RO	-	-	200	Float	57	
Belt Load	RO	-	-	100	Float	59	
Belt Speed	RO	-	-	200	Float	61	
Master Total	RO	-	-	100	float	63	
Operator Total	RW	0	0	100	Float	65	
Reset Total	RW	0	0	100	float	67	
Batch Total	RO	-	-	100	float	69	
Master Total Double	RO	-	-	100	double	71	
Operator Total Double	RW	0	0	100	double	75	
Reset Total Double	RW	0	0	100	double	79	
Batch Total Double	RW	0	0	100	double	83	
Manual Zero	RW	0	120000	-	long	89	
Manual Span	RW	500000	45000000	-	float	91	
DISPLAY DATA MENU							
Units	RW	Tab.6	Tab.6	-	integer	95	
Total units	RW	Tab.7	Tab.7	-	integer	96	
Length units	RW	Tab.8	Tab.8	-	integer	97	
Rate units	RW	Tab.9	Tab.9	-	integer	98	
Weight units		Tab.10	Tab.10				

Register	Type	Low Limit	High Limit	Refresh Time [ms]	Format	Address (word)	Note
	RW			-	integer	99	
Language	RW	Tab.11	Tab.11	-	integer	100	
Time Format	RW	Tab.12	Tab.12	-	integer	101	
Date Format	RW	Tab.13	Tab.13	-	integer	102	
Line 3 Display	RW	Tab.14	Tab.14	-	integer	103	
Rate Damping	RW	0	400	-	integer	104	
Load Damping	RW	0	400	-	integer	105	
Speed Damping	RW	0	400	-	integer	106	
SCALE DATA MENU							
Scale Capacity	RW	1	200000	-	float	109	
Scale Division	RW	Tab.15	Tab.15	-	integer	111	
Scale Model	RW	0	10000	-	integer	112	
Idler Space	RW	Tab.16	Tab.16	-	float	113	
Angle	RW	-25	+25	-	float	115	
Load Cell Capacity	RW	Tab.17	Tab.17	-	float	117	
Load Cell Sensitivity	RW	0.5	3.5	-	float	119	
Load Cell Resistance 1	RW	10	2000	-	float	121	
Load Cell Resistance 2	RW	10	2000	-	float	123	
Load Cell Resistance 3	RW	10	2000	-	float	125	
Load Cell Resistance 4	RW	10	2000	-	float	127	
Load Cell Resistance 5	RW	10	2000	-	float	129	
Load Cell Resistance 6	RW	10	2000	-	float	131	
Speed Input	RW	Tab.18	Tab.18	-	integer	133	
Dead Band	RW	0.0	5.0	-	float	134	

Register	Type	Low Limit	High Limit	Refresh Time [ms]	Format	Address (word)	Note
CALIBRATION DATA MENU							
Calibration Mode	RW	Tab.19	Tab.19	-	Integer	138	
Calibration Resistance	RW	10	1000000	-	long	139	
Calibration Constant	RO	-	-	-	float	141	
Chain Weight	RW	Tab.20	Tab.20	-	float	143	
Chain Constant	RO	-	-	-	float	145	
Test Weight	RW	Tab.21	Tab.21	-	float	147	
Weight Constant	RO	-	-	-	float	149	
Calibration Interval	RW	0	365	-	integer	151	
Rcal Factor	RW	-99.99	+99.99	-	float	152	
Chain Factor	RW	-99.99	+99.99	-	float	154	
Weight Factor	RW	-99.99	+99.99	-	float	156	
Test Duration Length	RW	1	100000	-	float	158	
Test Durat. Leng. Full	RW	Tab.22	Tab.22	-	float	160	
Test Durat. Leng. Part.	RW	Tab.23	Tab.23	-	float	162	
Test Durat. Leng. Man.	RW	Tab.24	Tab.24	-	float	164	
Test Duration revs.	RW	1	100	-	integer	166	
Test Duration Time	RW	10	16200	-	integer	167	
Azt opt.	RW	Tab.25	Tab.25	-	Integer	168	
Azt Range	RW	0.0	10.0	-	float	169	
Azt Deviation	RW	0.0	10.0	-	float	171	
Speed Capacity	RW	Tab.26	Tab.26	-	float	173	
Calibration Number	RW	1	2	-	Integer	175	
Protection Level	RO	-	-	-	Integer	178	

Register	Type	Low Limit	High Limit	Refresh Time [ms]	Format	Address (word)	Note
DIAGNOSTIC MENU							
AD Gross	RO	-	-	-	long	179	
AD Net	RO	-	-	-	long	181	
Weight Load Cell	RO	-	-	-	float	183	
Zero Load Cell	RW	0	10000	-	integer	185	
Span Load Cell	RW	0	30000	-	integer	186	
Prescaler	RO	-	-	-	integer	187	
Test Duration Pulses	RW	1	1000000	-	long	188	
Test Duration Length	RW	1	100000	-	float	190	
Service Password	RW	Tab.27	Tab.27	-	Integer	192	
Operator Password	RW	Tab.28	Tab.28	-	integer	197	
Software version	RO	-	-	-	integer	202	
I/O DATA MENU							
Analog Out Definition	RW	Tab.29	Tab.29	-	integer	210	
Analog Out Range	RW	Tab.30	Tab.30	-	integer	211	
Analog Out Delay Leng.	RW	Tab.31	Tab.31	-	float	212	
Analog Out Delay Time	RW	0	300	-	integer	214	
Analog Out Filter	RW	0	400	-	integer	215	
Digital input 1 assign	RW	Tab.32	Tab.32	100	integer	216	
Digital input 2 assign	RW	Tab.32	Tab.32	100	integer	217	
Digital input 3 assign	RW	Tab.32	Tab.32	100	integer	218	
Digital input 4assign	RW	Tab.32	Tab.32	100	integer	219	
Digital input 5 assign	RW	Tab.32	Tab.32	100	integer	220	
Digital input 6 assign	RW	Tab.32	Tab.32	100	integer	221	
Digital input 7			Tab.32				

Register	Type	Low Limit	High Limit	Refresh Time [ms]	Format	Address (word)	Note
assign	RW	Tab.32		100	integer	222	
Digital input 8 assign	RW	Tab.32	Tab.32	100	integer	223	
Digital input 9 assign	RW	Tab.32	Tab.32	100	integer	224	
Digital input 10 assign	RW	Tab.32	Tab.32	100	integer	225	
Digital input 11 assign	RW	Tab.32	Tab.32	100	Integer	226	
Digital input 12 assign	RW	Tab.32	Tab.32	100	integer	227	
Digital output 1 assign	RW	Tab.33	Tab.33	100	integer	228	
Digital output 2 assign	RW	Tab.33	Tab.33	100	integer	229	
Digital output 3 assign	RW	Tab.33	Tab.33	100	integer	230	
Digital output 4 assign	RW	Tab.33	Tab.33	100	integer	231	
Digital output 5 assign	RW	Tab.33	Tab.33	100	integer	232	
Digital output 6 assign	RW	Tab.33	Tab.33	100	integer	233	
Digital output 7 assign	RW	Tab.33	Tab.33	100	integer	234	
Digital output 8 assign	RW	Tab.33	Tab.33	100	integer	235	
Digital output 9 assign	RW	Tab.33	Tab.33	100	integer	236	
Digital output 10 assign	RW	Tab.33	Tab.33	100	integer	237	
Digital output 11 assign	RW	Tab.33	Tab.33	100	integer	238	
Digital output 12 assign	RW	Tab.33	Tab.33	100	integer	239	
Digital output 13 assign	RW	Tab.33	Tab.33	100	integer	240	
Digital output 14 assign	RW	Tab.33	Tab.33	100	integer	241	
Digital output 15 assign	RW	Tab.33	Tab.33	100	integer	242	
Digital output 16	RW	Tab.33	Tab.33	100	integer	243	

Register	Type	Low Limit	High Limit	Refresh Time [ms]	Format	Address (word)	Note
assign							
Totalizer Out. Pulse	RW	0.001	100.0	100	float	244	
Totalizer Out. Duration	RW	0.005	1.0	100	float	246	
Clip Detection Mode	RW	Tab.34	Tab.34	100	Integer	248	
Clip Detection Length	RW	Tab.35	Tab.35	100	float	249	
ALARMS THRESHOLDS MENU							
Rate dev. Opt.	RW	Tab.36	Tab.36	-	integer	253	
Low rate delay	RW	0	90	-	integer	254	
Low rate set	RW	0	105 %	-	float	255	
High rate delay	RW	0	90	-	integer	257	
High rate set	RW	0	150 %	-	float	258	
Load dev. Opt.	RW	Tab.37	Tab.37	-	integer	260	
Low load delay	RW	0	90	-	integer	261	
Low load set	RW	0	105 %	-	float	262	
High load delay	RW	0	90	-	integer	264	
High load set	RW	0	200 %	-	float	265	
Speed dev. Opt.	RW	Tab.38	Tab.38	-	integer	267	
Low speed delay	RW	0	90	-	integer	268	
Low speed set	RW	0	105 %	-	float	269	
High speed delay	RW	0	90	-	integer	271	
High speed set	RW	0	150 %	-	Float	272	
ALARMS MENU							
Alarm define 1	RW	Tab.39	Tab.39		integer	276	
Alarm define 2	RW	Tab.39	Tab.39		integer	277	
Alarm define 3	RW	Tab.39	Tab.39		integer	278	
Alarm define 4	RW	Tab.39	Tab.39		integer	279	
Alarm define 5	RW	Tab.39	Tab.39		integer	280	

Register	Type	Low Limit	High Limit	Refresh Time [ms]	Format	Address (word)	Note
Alarm define 6	RW	Tab.39	Tab.39		integer	281	
Alarm define 7	RW	Tab.39	Tab.39		integer	282	
Alarm define 8	RW	Tab.39	Tab.39		integer	283	
Alarm define 9	RW	Tab.39	Tab.39		integer	284	
Alarm define 10	RW	Tab.39	Tab.39		Integer	285	
Alarm define 11	RW	Tab.39	Tab.39		integer	286	
Alarm define 12	RW	Tab.39	Tab.39		integer	287	
Alarm define 13	RW	Tab.39	Tab.39		integer	288	
Alarm define 14	RW	Tab.39	Tab.39		integer	289	
Alarm define 15	RW	Tab.39	Tab.39		integer	290	
Alarm define 16	RW	Tab.39	Tab.39		integer	291	
Alarm define 17	RW	Tab.39	Tab.39		integer	292	
Alarm define 18	RW	Tab.39	Tab.39		integer	293	
Alarm define 19	RW	Tab.39	Tab.39		integer	294	
Alarm define 20	RW	Tab.39	Tab.39		integer	295	
Alarm define 21	RW	Tab.39	Tab.39		integer	296	
Alarm define 22	RW	Tab.39	Tab.39		integer	297	
Alarm define 23	RW	Tab.39	Tab.39		integer	298	
Alarm define 24	RW	Tab.39	Tab.39		integer	299	
Alarm define 25	RW	Tab.39	Tab.39		integer	300	
Alarm define 26	RW	Tab.39	Tab.39		integer	301	
Alarm define 27	RW	Tab.39	Tab.39		integer	302	
Alarm define 28	RW	Tab.39	Tab.39		integer	303	
Alarm define 29	RW	Tab.39	Tab.39		integer	304	
Alarm define 30	RW	Tab.39	Tab.39		integer	305	
NET MENU							
I.P. Address			254.255.255.255				

Register	Type	Low Limit	High Limit	Refresh Time [ms]	Format	Address (word)	Note
	RW	0.0.0.0		-	integer	308	
Net Mask Address	RW	0.0.0.0	255.255.255.255	-	integer	316	
Variables selection	RW	Tab. 40	Tab.40	-	integer	324	
Swap integer data	RW	Tab.41	Tab.41	-	integer	325	
Swap float data	RW	Tab.42	Tab.42	-	integer	326	
SERIAL MENU							
Baud rate	RW	Tab.43	Tab.43	-	integer	327	
Parity	RW	Tab.44	Tab.44	-	integer	328	
Stop Bit	RW	Tab.45	Tab.45	-	integer	329	
Word Length	RW	Tab.46	Tab.46	-	integer	330	
Protocol	RW	Tab.47	Tab.47	-	integer	331	
Access level	RW	Tab.48	Tab.48	-	integer	332	
Clear to Send	RW	Tab.49	Tab.49	-	integer	333	
Address	RW	1	255	-	integer	334	
Half duplex delay	RW	0	50	-	integer	335	
PROFIBUS MENU							
Address	RW	1	126	-	integer	339	
Read Buffer Length	RW	5	48	-	integer	340	
Write Buffer Length	RW	5	48	-	integer	341	
LOAD OUT MENU							
Batch Option	RW	Tab.50	Tab.50	-	integer	357	
Preset	RW	0	10000	-	float	358	
CutOff Corr	RW	Tab.51	Tab.51	-	integer	360	
CutOff queue	RW	0	10000	-	float	361	
CutOff Len	RW	Tab.52	Tab.52	-	float	363	
CutOddDev	RW	0	10000	-	float	365	
Start Delay	RW	0	600	-	integer	367	
Stabilization Time	RW	0	600	-	integer	368	

Register	Type	Low Limit	High Limit	Refresh Time [ms]	Format	Address (word)	Note
Batch Deviation	DW	0	100	-	integer	369	

Tab. 4 – Variables list

3.3 Description of Registers

Below the description of the register and their use.

Sim_Key The master has the possibility to send a key code to the instrument. Interpreted key codes are:

Key	Key Code	Key	Key Code
UP ARROW	0048 H	F1	003F H
DOWN ARROW	0050 H	F2	0040 H
RUN	0052 H	F3	0041 H

Tab 5 - key codes

Write Flag Set to 0 after a message has been received and properly processed. If a message is correctly received but cannot be processed because password protection or size error, this flag is set to 1. The user may read this register after a write message to ensure the data have been accepted.

Display Contains the messages actually shown on the display of the instrument in form of an ASCII string. For example the following screen:

```
-        MENU MAIN 1        -
 PRESS MENU FOR MORE
 ZERO    SPAN    MAT'L
 CAL     CAL      CAL
```

Will be stored in registers in the following way:

Display(1)	2DH	20H	Characters 1 and 2 from left of first row
Display(2)	4DH	45H	
Display(3)	4EH	55H	
Display(4)	20H	4DH	
Display(5)	41H	49H	
Display(6)	4EH	20H	
…..			
Display(10)	….	….	Characters 19 and 20 from left of first row
Display (11)	….	….	Characters 1 and 2 from left second row
…..			
Display(20)	….	….	Characters 19 and 20 from left of second row
Display(21)	….	….	Characters 1 and 2 from left of third row
…..			
Display(30)	….	….	Characters 19 and 20 from left of third row
Display(31)	….	….	Characters 1 and 2 from left of fourth row
…..			
Display(38)	4CH	20H	
Display(39)	20H	20H	
Display(40)	20H	20H	Characters 19 and 20 from left of fourth row

3.3.1 Status

Panel Leds The word below indicates the status of the 5 leds on the front panel of the instrument.

Panel Led

NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	04	03	02	01	00

PL1.04 Run Led
PL1.03 Span Led
PL1.02 Zero Led
PL1.01 Ready Led
PL1.00 Alarm Led

Status

The actual status of the instrument is resumed in two words, each bit has an own meanings, when the bit is 1 the associated status is true.

Status 1 - Generals

15	14	13	NU	NU	10	NU	08	07	06	05	04	03	02	NU	NU

S1.15 Cumulative shut down
S1.14 Cumulative Alarms
S1.13 Calibration running
S1.12 Free
S1.11 Free
S1.10 Running
S1.09 Free
S1.08 Ready
S1.07 High load
S1.06 Low load
S1.05 High rate
S1.04 Low rate
S1.03 High speed
S1.02 Low speed
S1.01 Free
S1.00 Free

Status 2 - Control deviations & Batch

NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	03	02	01	00

Only applicable if Load Out option installed :

S2.03	S2.02	S2.01	S2.00	
x	0	0	0	Batch not running
x	0	0	1	Not used
x	0	1	0	Batch running at high rate
x	0	1	1	Batch running at low rate
x	1	0	0	Waiting start delay time
x	1	0	1	Waiting stabilization time
1	x	x	x	Batch suspended

x can be : 0 Normal status
1 Stand by status

S2.15 Free
S2.14 Free
S2.13 Free
S2.12 Free
S2.11 Free
S2.10 Free
S2.09 Free
S2.08 Free
S2.07 Free
S2.06 Free
S2.05 Free
S2.04 Free

Alarms

In the alarms register, each bit represents the status of an alarm. If the alarm is active, the relevant bit will contain '1', otherwise it will contain '0'.

Alarms 1

NU	14	NU	NU	11	10	09	08	07	06	05	04	03	02	01	00

A1.15 Free
A1.14 CELL FAIL
A1.13 Free
A1.12 Free
A1.11 SPEED SENSOR ERROR
A1.10 HIGH LOAD
A1.09 LOW LOAD
A1.08 HIGH RATE
A1.07 LOW RATE
A1.06 HIGH SPEED
A1.05 LOW SPEED
A1.04 WARM START
A1.03 COLD START
A1.02 PWD DURING CALIB
A1.01 CAL TIME ELAPSED
A1.00 EXTERNAL ALARM

Alarms 2

NU	NU	13	12	11	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU

A2.15 Free
A2.14 Free
A2.13 OVERFLOW TOTALIZER
A2.12 AZT OVER LIMIT
A2.11 BATCH DEVIATION
A2.10 Free
A2.09 Free
A2.08 Free
A2.07 Free
A2.06 Free
A2.05 Free
A2.04 Free
A2.03 Free
A2.02 Free
A2.01 Free

Alarms 3

15	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU

A3.15 PROFIB COMM ERROR
A3.14 Free
A3.13 Free
A3.12 Free
A3.11 Free
A3.10 Free
A3.09 Free
A3.08 Free
A3.07 Free
A3.06 Free
A3.05 Free
A3.04 Free
A3.03 Free
A3.02 Free
A3.01 Free
A3.00 Free

I/O Image

The instrument has physical inputs and outputs to which logical input and output functions are associated. As far as communication is concerned, only the status of physical inputs and outputs are transferred.

Input Image – Inputs installed on board

NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	01	00

I1.01 in 2 - mother board
I1.00 in 1 - mother board

Output Image – Outputs installed on board

NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	04	03	02	01	00

O1.04 output 5 - mother board
O1.03 output 4 - mother board
O1.02 output 3 - mother board
O1.01 output 2 - mother board
O1.00 output 1 - mother board

Commands

Each bit of the commands register is specified as follows. In order to give a command, the Host must set the relevant bit to 1 and write (send) the register to the instrument. The action will be performed if the write message is accepted.

Commands

15	NU	NU	NU	NU	10	09	08	07	06	05	04	03	02	01	00

C1.15 SAVE SETUP DATA
C1.14 NOT USED
C1.13 NOT USED
C1.12 NOT USED
C1.11 NOT USED
C1.10 CLEAR OPER. TOTAL
C1.09 CLEAR RESET TOTAL
C1.08 REMOTE SPAN CALIBR. (RCAL)
C1.07 REMOTE SPAN CALIBR. (CHAIN)
C1.06 REMOTE SPAN CALIBR. (WTS)
C1.05 REMOTE START ZERO
C1.04 CONFIRM ZERO / SPAN
C1.03 STANDBY BATCH
C1.02 STOP BATCH
C1.01 START BATCH
C1.00 RESET ALARM

Calibration commands:
It is possible to start a calibration function from remote. At the end of the calibration (calibration flag in status registers should be tested to determines when cal function ends) it is possible to verify the calibration error ('cal_error' register) and eventually accept the new zero or span.

Autospan RCAL	Start the autospan function with RCAL method. The Rcal is automatically connected by the instrument at the begin of the function and disconnected at its end. This operation needs a delay of 0.5 seconds. In case a RCAL remote calibration is aborted , the calibration flags will turn off after this delay.
Autospan WTS	Start the autospan function with WTS method. An output of the MiniCK can be programmed to automatically load the test weights, this adds a 10 seconds delay at the begin and at the end of the calibration function. In case a WTS remote calibration is aborted , the calibration flags will turn off after this time.
Autozero	Start the autozero function.

Confirm zero/span (C1.04) at the end of the calibration function tells to the instrument to save the new zero or span. If this command is sent during a remote calibration it aborts the running function.

Batch commands:

The batch can be controlled by Modbus TCP :

Stop Batch	Temporarily stops a Load Out (batch) sequence. Batch can resume if a Start command is sent later.
Abort Batch	Definitively interrupt a Load Out (batch) sequence.
Start Batch	Starts a Load Out (batch) sequence.

Reset Commands

When the instrument receives a 'Clear Reset total' or a 'Reset alarm' command, it executes the command for all the scales.

Clear Operator total	Clear the operator total register.
Clear Reset total	Clear the reset total register.
Reset Alarms	Reset any pending alarm

In order to give a command, the Host must set the relevant bit to 1 and write (send) the register to the instrument. The action will be performed if the write message is accepted.

Virtual I/O Image

To allow an easy management when the MINI CK 101 is connected to a network, is possible to perform the I/O exchange only at level software, without using the available hardware I/O . Two words are dedicated for this function one for the Inputs and one for the outputs according the mapping and description below.

Virtual Input Image

NU	NU	NU	NU	11	10	09	08	07	06	05	04	03	02	NU	00

VI1.15	Free	VI1.07	Start batch
VI1.14	Free	VI1.06	Clip detect
VI1.13	Free	VI1.05	Auto zero
VI1.12	Free	VI1.04	Reset alarms
VI1.11	Calib. 2	VI1.03	Reset totals
VI1.10	Calib. 1	VI1.02	Belt running
VI1.09	Stand-by batch	VI1.01	Free
VI1.08	Stoop batch	VI1.00	Ext. Input

Virtual Output Image

15	14	NU	12	11	10	09	08	07	06	05	04	03	02	01	00

VO1.16	Cumul. Rate Deviation	VO1.07	High Speed
VO1.14	Cumul. Deviation Alarm	VO1.06	Low Rate
VO1.15	Load Test weight	VO1.05	High Rate
VO1.13	Free	VO1.04	Low Load
VO1.12	Batch High Rate	VO1.03	High Load
VO1.11	Batch Low Rate	VO1.02	Ready
VO1.10	Totalizer	VO1.01	Cumulative Shut down
VO1.08	Low Speed	VO1.00	Cumulative Alarm

3.3.2 Dynamic Values

Batch Counter	The number of the currently running load out or the number of the last finished one. The integrator automatically increments the batch number when a new batch is started.
Batch_Set	The set point for the current or the next load out. Usually entered or downloaded by the user. For reading operations, the Batch_set value is updated only when a batch is started.
Rate	The instantaneous rate in engineering units as currently displayed on the RUN screen.
Belt Load	The instantaneous linear weight in engineering units.
Belt Load	The instantaneous belt speed in engineering units.
Master Total	The current value of the master Totalizer of the integrator.
Operator Total	The current value of the operator Totalizer of the integrator. Operator total can be zeroed by writing zero to this register.
Reset Total	The current value of the reset Totalizer of the integrator. Reset total can be zeroed by writing zero to this register.
Batch Total	The current contents of the load out totalizer. Usually read at end of batch to check the result of the load out. This register is automatically cleared when a new batch is started
Master Total	The current value of the master Totalizer of the integrator, in double format
Operator Total	The current value of the Operator Totalizer of the integrator, in double format
Reset Total	The current value of the Reset Totalizer of the integrator, in double format
Batch Total	The current value of the Batch Totalizer of the integrator, in double format
Manual Zero	The value in engineering units of the “Zero” constant of the scale.
Manual Span	The value in engineering units of the “Span” constant of the scale.

3.3.3 Display Data

Units Code of the “Measure Units” displayed according the table below:

SETTINGs	CODE
METRIC	00H
ENGLISH	01H
MIXED	02H

Tab 6 – Units codes

Total Units Code of the “Totalization Units” displayed according the table below:

SETTINGs	CODE
KG	00H
TONNES	01H
POUNDS	02H
TONS	03H
LTONS	04H

Tab 7 – Total units code

Length Units Code of the “Lenght Units” displayed according the table below:

SETTINGs	CODE
METERS	00H
FEET	01H

Tab 8 – Length unit codes

Rate Units Code of the “Rate Units” displayed according the table below:

SETTINGs	CODE
PERCENT %	00H
KG/H	01H
t/H	02H
LB/H	03H
TPH	04H
LTPH	05H
KG/MN	06H
t/MN	07H
LB/MN	08H
T/MN	09H
LT/MN	0AH

Tab 9 – Rate units codes

Weight Units Code of the "LoadCells Units" displayed according the table below:

SETTINGs	CODE
KG	00H
POUNDS	02H

Tab 10 – Weight units codes

Language Code of the setted "Language" according the table below

SETTINGs	CODE
USA	00H
SPANISH	01H
ITALIAN	02H
FRENCH	03H
GERMAN	04H
DUTCH	05H

Tab 11 – Language code

Time Format Code of the setted "Time Format" according the table below:

SETTINGs	CODE
12H	00H
24H	01H

Tab 12 – Time format codes

Date Format Code of the setted "Date Format" according the table below:

SETTINGs	CODE
GG-MM-YYYY	00H
MM-GG-YYY	01H

Tab 13 – Date format codes

Line 3 Display Code of the setted "Line 3 Display" according the table below:

SETTINGs	CODE
SPEED	00H
LOAD	01H
Not Used	02H
NO DISPLAY	03H

Tab 14 – Line 3 display codes

Rate Damping	The Value in seconds of the displayed “Rate Damping”.
Load Damping	The Value in seconds of the displayed “Load Damping”.
Speed Damping	The Value in seconds of the displayed “Speed Damping”

3.3.4 Scale Data

Scale Capacity The maximum rate of the integrator, entered by the user in the instrument setup. It is the reference value for the high and low rate set expressed in per cent.

Scale Division Code of the Scale decimal places (Division) actually setted, according the table below:

SETTINGs	CODE
50	00H
20	01H
10	02H
5	03H
2	04H
1	05H
0,5	06H
0,2	07H
0,1	08H
0,05	09H
0,02	0AH
0,01	0BH
0,005	0CH
0,002	0DH
0,001	0EH

Tab 15- scale division codes

Scale model The code number of Ramsey Scale used for internal calibration calculation.

Idler Space The value in engineering units of the distance between the idlers across the scale.

The min and maximun limits for this one are :

UNITS	Feet	Meters	
LANGUAGE		ITA	OTHER
MAX	120	25000	2500
MIN	2	50	50

Tab 16- Idler space limits

Angle The value in engineering units of the Angle of Inclination of the Scale.

Load Cell Capacity The value in engineering units of the Capacity of the load cell, as it appear on the label.

UNITS	Pounds	Kg
MAX	15000	5000
MIN	1	1

Tab 17- Load cell capacity limits

Load Cell Sensitivity The value in mV/V of the load cell Sensitivity.
Load Cell Resistance 1 The value in engineering units of the Input Resistance of the load cell N° 1
Load Cell Resistance 2 The value in engineering units of the Input Resistance of the load cell N° 2
Load Cell Resistance 3 The value in engineering units of the Input Resistance of the load cell N° 3
Load Cell Resistance 4 The value in engineering units of the Input Resistance of the load cell N° 4.
Load Cell Resistance 5 The value in engineering units of the Input Resistance of the load cell N° 5
Load Cell Resistance 6 The value in engineering units of the Input Resistance of the load cell N° 6
Speed Input Code of the "Speed Sensor Input" selected according the table below:

SETTINGs	CODE
SINGLE	00H
SIMULATED	01H

Tab 18 – speed input code

Dead Band The value in percentage of the scale capacity (rate) in which the rate is ignored.

3.3.5 Calibration Data

Calibration Mode Code of the "Calibration mode" selected according the table below:

SETTINGs	CODE
R-CAL	00H
TEST CHAIN	01H
TEST WEIGHT	02H

Tab 19 – calibration code

Calibration Resistance The value of the resistor used for the "Calibration with Resistance".
Calibration Constant The value of the constant for the resistance calculated by instrument.
Chain Weight The value in engineering units of the chain used as a sample weight for calibration.

UNITS	English	Metric
MAX	1000	3000
MIN	0	0

Tab 20- Chain weight limits

Chain Constant The value of the constant for the chain calculated by instrument.

Test Weight The value in engineering units of the sample weight used for calibration :

UNITS	English	Metric
MAX	LC CAP * LC NUMBER	LC CAP * LC NUMBER
MIN	0	0

Tab 21- Test weight limits

Weight Constant The value of the constant for the sample weight calculated by instrument.

Calibration Interval Number of selected days between two calibration.

RCal Factor Number in percentage used to correct the "Calibration Constant" value to the real value.

Chain Factor Number in percentage used to correct the "Chain Constant" value to the real value.

Weight Factor Number in percentage used to correct the "Weight Constant" value to the real value.

Test Duration Length The value in engineering units of one complete belt revolution.

Test Durat. Length Full The value in engineering unit of the measured length of "one belt revolution" :

UNITS	Feet	Meters
MAX	10000	3000
MIN	1	0.5

Tab 22- Test duration length full limits

Test Durat. Length Partial The value in engineering unit of the measured partial length of "belt".

UNITS	Feet	Meters
MAX	10000	3000
MIN	1	0.5

Tab 23- Test duration length partial limits

Test Durat. Length Manual The value in engineering unit of the measured length of "one belt revolution" :

UNITS	Feet	Meters
MAX	10000	3000
MIN	1	0.5

Tab 24- Test duration length manual limits

Test Duration The value in engineering units of the last performed calibration.

Test Duration Time The value in second of the last performed calibration.

Azt opt. The enable option for AZT function.

SETTINGs	CODE
NO	00H
YES	01H

Tab 25 – Azt option limits

Azt Range The value in percentage of the Range of action of AutoZero tracking with reference to the scale capacity.

Azt Deviation The value in engineering units of the Maximum amount of zero error, that the AutoZero tracking can automatically compensate.

Speed Capacity The value in engineering units of the maximum speed capacity of the system.

UNITS	Feet	Meters
MAX	2000	10
MIN	1	0.1

Tab 26- Speed capacity limits

Calibration Number The value of Number of calibration defined

Protection Level Protection level of the instrument when password is enetred.

3.3.6 Diagnostic data

AD Gross Instantaneous value in engineering units of the AD counter converter (Gross).

AD Net Instantaneous value in engineering units of the AD counter converter (Net Only).

Weight Load Cell Instantaneous Value in mV of the load cell.

Zero Load Cell Value in engineering units of the AD converter equivalent to the Zero Calibration.

Span Load Cell Value in engineering units of the AD converter equivalent to the Span Calibration.

Prescaler Reduction factor for speed sensor count.

Test Duration Pulses N° of counted pulses during the material calibration.

Test Duration Length Length in meter equivalent to one or more belt revolution used for material calibration.

Service Password Numeric digit or a letter of the alphabet used by service people.The maximum length is 10 ascii characters:

VALID RANGE
a – z
A – Z
0 - 9

Tab 27- Service password limit

Operator Password Numeric digit or a letter of the alphabet used by operator people. The maximum length is 10 ascii characters:

VALID RANGE
a – z
A – Z
0 - 9

Tab 28- Operator password limit

Software version Release of the Instrument firmware's.

3.3.7 I/O Data

Analog Out Definition Code of the setted "Out function" according the table below:

SETTINGs	CODE
NONE	00H
RATE	01H
SPEED	02H
LOAD	03H

Tab 29 – analog out define code

Analog Out Range Code of the setted "Range" according the table below:

SETTINGs	CODE
0-20 mA	00H
4-20 mA	01H
20-0 mA	02H
20-4 mA	03H

Tab 30 – analog out range code

Analog Out Delay Length The value in meter of the delay of the Analog Output.

UNITS	Feet	Meters
MAX	10000	300
MIN	0	0

Tab 31- Analog out delay length limits

Analog Out delay Time The value in second of the delay of the Analog Output.

Analog Out Filter The value in second that the output takes for the stabilization after a status variation.

Digital inputs assign The digital inputs configuration.

INPUT ASSIGN NUMBERS	
MAX	2
MIN	0

Tab 32- Digital input assign numbers limits

Digital outputs assign The digital oputputs configuration.

OUTPUT ASSIGN NUMBERS	
MAX	5
MIN	0

Tab 33- Digital output assign numbers limits

Totalizer Output Pulse Frequency value (divisor) relevant the weight for which the output is activate.

Totalizer Output Durat. The value in seconds of the duration of the pulse of the totalizer output's

Clip Detection Mode Code of the setted "Clip Detection Mode" according the table below:

SETTINGs	CODE
MANUAL	00H
AUTO	01H

Tab 34 – Clip detect range code

Clip Detection Length

The value in meter, of the belt length, for which the calculation of Rate, must be kept freezed.

UNITS	Feet	Meters
MAX	10	3
MIN	0.5	0.1

Tab 35- Clip detect length limits

3.3.8 Alarms

Rate deviation opt. Enable the rate alarm condition.

SETTINGs	CODE
NO	00H
YES	01H

Tab 36 – Rate dev. option limits

Low rate delay Delay time for low rate alarm condition.

Low rate set Set value for low rate alarm condition.

High rate delay Delay time for high rate alarm condition.

High rate set Set value for high rate alarm condition.

Load deviation opt. Enable the load alarm condition.

SETTINGs	CODE
NO	00H
YES	01H

Tab 37– Load dev. option limits

Low load delay Delay time for low load alarm condition.

Low load set Set value for low load alarm condition.

High load delay Delay time for high load alarm condition.

High load set Set value for high load alarm condition.

Speed deviation opt. Enable the speed alarm condition.

SETTINGs	CODE
NO	00H
YES	01H

Tab 38 – Speed dev. option limits

Low speed delay Delay time for low speed alarm condition.

Low speed set Set value for low speed alarm condition.

High speed delay Delay time for high speed alarm condition.

High speed set Set value for high speed alarm condition.

Alarm defines The user can select the desired mode between ALARM (just a warning message), SHUT DOWN (Warning message) and NONE (no action).

Code of the setted “Alarm define mode” according the table below:

SETTINGs	CODE
AD_NONE	00H
AD_ALARM	01H
AD_SHUTDOWN	02H

Tab 39 – Alarm define code

3.3.9 Ethernet Settings

I.P. Address Represent the value of the I.P address of the device (default : 169.254.1.3).

SubNet Mask Represent the value of the Subnet Mask configured on the device (default : 255.255.255.000).

Variable Selection Code of mode on how the variable are transmitted according the table below:

SETTINGs	WORD
NO DUMPED	00H
DUMPED	01H
DISPLAYED	02H

Tab 40– Variable selection range code

Swap integer data Mode to swap integer data in the communication protocols :

SETTINGs	WORD
S_COM_SWAP_NONE	00H
S_COM_SWAP_BYTES	01H
S_COM_SWAP_WORD	02H
S_COM_SWAP_BYTES_WORD	03H

Tab 41– Variable selection range code

Swap float data Mode to swap float data in the communication protocols :

SETTINGs	WORD
S_COM_SWAP_NONE	00H
S_COM_SWAP_BYTES	01H
S_COM_SWAP_WORD	02H
S_COM_SWAP_BYTES_WORD	03H

Tab 42– Variable selection range code

3.3.10 Serial Settings

Baud Rate Communication parameter: Speed

SETTINGs	CODE
110	00H
150	01H
300	02H
600	03H
1200	04H
2400	05H
4800	06H
9600	07H
19200	08H

Tab 43 – Baud rate

Parity Communication parameter: Parity

SETTINGs	CODE
None	00H
Even	01H
Odd	02H

Tab 44 – Parity

Stop Bit Communication parameter: Stop bit

SETTINGs	CODE
1	00H
2	01H

Tab 45 – Stop Bit

Wordlenght Communication parameter: Wordlenght

SETTINGs	CODE
7	00H
8	01H

Tab 46 – Word length

Protocol Communication parameter: Protocol

SETTINGs	CODE
PRINTER	00H
MODBUS	01H

Tab 47 – Protocol

Access level Communication parameter: access level

SETTINGs	CODE
PROTECTED	00H
LIMITED	01H
NONE	02H

Tab 48 – Access level

Clear to send Communication parameter: Clear to send

SETTINGs	CODE
ACTIVE	00H
DISABLED	01H

Tab 49 – Clear to Send

Address Address of the device in the serial Line (only for multidrop)

Half duplex delay Response delay for two wire connection

3.3.11 Profibus Settings

Address	Address of the device in the Profibus network.
Read Buffer Length	Size in N° of word the Reading Buffer.
Write Buffer Length	Size in N° of word the Writing Buffer.

3.3.12 Load Out (Batch)

Batch Option Enable the load out function.

SETTINGs	CODE
NO	00H
YES	01H

Tab 50 – Batch option limits

Batch Preset The pre-set point for the current or the next load out. Defines when the rate will be lowered to increase batch accuracy.

CutOff Corr. The CutOff correction is the amount of material which flows on the belt scale after the batch end has been turned off. Select the method you want to use :

SETTINGs	WORD
S_COFFNONE	00H
S_COFFADJ	01H
S_COFFAUTO	02H

Tab 51 – CutOff correction code

CutOff queue If the selection of the **CutOff Corr** is S_COFFNONE, the user can directly enter the CutOff queue.

CutOff len If the selection of the **CutOff Corr** is S_COFFAUTO , the user can enter the length of belt travel between the scale and the feeding point:

UNITS	Feet	Meters
MAX	300	100
MIN	0	0

Tab 52- CutOff len limits

CutOff dev If the selection of the **CutOff Corr** is S_ S_COFFADJ, the user must enter the maximum correction that the system is allowed to perform to the cut-off value.

.

Start Delay After the start command has been given, the system will wait the start delay entered here before activating the batch command.

Stabilization time After the batch command has been turned off at end of batch, the system will wait the coasting time entered here before freezing the batch total and print the batch data.

Batch deviation At end of batch, the system checks the error. If error is larger than the batch deviation entered here, an alarm is generated.

4 QUERY, RESPONSE MESSAGES AND EXAMPLE

Below there are the structure of the data query from a Master (PLC) to the Salve (MINI CK 101)
Starting from the slave address field, the structure is that of the MODBUS message, except for error check field.

4.1 Read Operation Example (Function 03)

QUERY (CLIENT)

Transaction identifier	:	xx
Transaction identifier	:	xx
Protocol identifier	:	xx
Protocol identifier	:	xx
Length	:	xx
Length	:	xx
Unit identifier	:	xx
Function code	:	xx
Start address Hi	:	xx
Start address Lo	:	xx
Nr. of data Hi	:	xx
Nr. of data Lo	:	xx

RESPONSE MESSAGE (SERVER)

Transaction identifier	:	xx
Transaction identifier	:	xx
Protocol identifier	:	xx
Protocol identifier	:	xx
Length	:	xx
Length	:	xx
Unit identifier	:	xx
Function code	:	xx
Byte count	:	xx
Data Hi	:	xx
Data Lo	:	xx
Data Hi	:	xx
Data Lo	:	xx

EXAMPLE 1 – READ HOLDING REGISTER

The Client wants to receive the Belt load :

Address of slave	:	01
Register N°	:	59 (3B Hex)
Type of register	:	Float
Load value	:	100,0 Kg/m

QUERY (CLIENT)

Transaction identifier	:	0x00
Transaction identifier	:	0x00
Protocol identifier	:	0x00
Protocol identifier	:	0x00
Length	:	0x00
Length	:	0x06
Unit identifier	:	0x01
Function code	:	0x03
Start address	:	0x00
Start address	:	0x3b
Nr. of data to read	:	0x00
Nr. of data to read	:	0x02

RESPONSE MESSAGE (SERVER)

Transaction identifier	:	0x00
Transaction identifier	:	0x00
Protocol identifier	:	0x00
Protocol identifier	:	0x00
Length	:	0x00
Length	:	0x07
Unit identifier	:	0x01
Function code	:	0x03
Bytes count	:	0x04
Data Hi	:	0x00
Data Lo	:	0x00
Data Hi	:	0x42
Data lo	:	0xc8

EXAMPLE 2 – READ HOLDING REGISTER
The Client wants to receive the Scale Division Settings :

Address of slave	:	01
Register N°	:	111 (6F Hex)
Type of register	:	integer
Division	:	0,1

<u>QUERY</u> (CLIENT)

Transaction identifier	:	0x00
Transaction identifier	:	0x00
Protocol identifier	:	0x00
Protocol identifier	:	0x00
Length	:	0x00
Length	:	0x06
Unit identifier	:	0x01
Function code	:	0x03
Start address	:	0x00
Start address	:	0x6F
Nr. of data to read	:	0x00
Nr. of data to read	:	0x01

RESPONSE MESSAGE (SERVER)

Transaction identifier	:	0x00
Transaction identifier	:	0x00
Protocol identifier	:	0x00
Protocol identifier	:	0x00
Length	:	0x00
Length	:	0x05
Unit identifier	:	0x01
Function code	:	0x03
Bytes count	:	0x02
Data Hi	:	0x00
Data Lo	:	0x08

4.2 *Write Operation Example*

PRESET SINGLE REGISTER(Function 6)

<u>QUERY</u> (CLIENT)			**RESPONSE MESSAGE (SERVER)**		
Transaction identifier	:	xx	Transaction identifier	:	xx
Transaction identifier	:	xx	Transaction identifier	:	xx
Protocol identifier	:	xx	Protocol identifier	:	xx
Protocol identifier	:	xx	Protocol identifier	:	xx
Length	:	xx	Length	:	xx
Length	:	xx	Length	:	xx
Unit identifier	:	xx	Unit identifier	:	xx
Function code	:	xx	Function code	:	xx
Register address Hi	:	xx	Register address Hi	:	xx
Register address Lo	:	xx	Register address Lo	:	xx
Preset data Hi	:	xx	Preset data Hi	:	xx
Preset data Lo	:	xx	Preset data Lo	:	xx

EXAMPLE 1
The Client wants to select (write) the language of the Instrument :

Address of slave	:	01
Register N°	:	100 (64 Hex)
Type of register	:	integer
Settings	:	French (03Hex)

<u>QUERY</u> (CLIENT)			**RESPONSE MESSAGE (SERVER)**		
Transaction identifier	:	0x00	Transaction identifier	:	0x00
Transaction identifier	:	0x00	Transaction identifier	:	0x00
Protocol identifier	:	0x00	Protocol identifier	:	0x00
Protocol identifier	:	0x00	Protocol identifier	:	0x00
Length	:	0x00	Length	:	0x00
Length	:	0x06	Length	:	0x04
Unit identifier	:	0x01	Unit identifier	:	0x01
Function code	:	0x06	Function code	:	0x06
Register address Hi	:	0x00	Register address Hi	:	0x00
Register address Lo	:	0x64	Register address Lo	:	0x64
Preset data Hi	:	0x00	Preset data Hi	:	0x00
Preset data Lo	:	0x03	Preset data Lo	:	0x03

<u>PRESET MULTIPLE REGISTERS (</u> Function 16)

<u>QUERY</u> (CLIENT)

Transaction identifier	:	xx
Transaction identifier	:	xx
Protocol identifier	:	xx
Protocol identifier	:	xx
Length	:	xx
Length	:	xx
Unit identifier	:	xx
Function code	:	xx
Start address Hi	:	xx
Start address Lo	:	xx
Nr. of register Hi	:	xx
Nr. of register Lo	:	xx
Bytes count	:	xx
Data Hi	:	xx
Data Lo	:	xx
Data Hi	:	xx
Data Lo	:	xx

RESPONSE MESSAGE (SERVER)

Transaction identifier	:	xx
Transaction identifier	:	xx
Protocol identifier	:	xx
Protocol identifier	:	xx
Length	:	xx
Length	:	xx
Unit identifier	:	xx
Function code	:	xx
Start address Hi	:	xx
Start address Lo	:	xx
Nr. of register Hi	:	xx
Nr. of register Lo	:	xx

EXAMPLE 1
The Client wants to write the scale capacity of the Instrument :

Address of slave	:	01
Register N°	:	109 (6D Hex)
Type of register	:	float
Settings	:	100.0 t/h

<u>QUERY</u> (CLIENT)

Transaction identifier	:	0x00
Transaction identifier	:	0x00
Protocol identifier	:	0x00
Protocol identifier	:	0x00
Length	:	0x00
Length	:	0x09
Unit identifier	:	0x01
Function code	:	0x10
Start address Hi	:	0x00
Start address Lo	:	0x6d
Nr. of register Hi	:	0x00
Nr. of register Lo	:	0x02
Bytes count	:	0x04
Data Hi	:	0x00
Data Lo	:	0x00
Data Hi	:	0x42
Data Lo	:	0xc8

RESPONSE MESSAGE (SERVER)

Transaction identifier	:	0x00
Transaction identifier	:	0x00
Protocol identifier	:	0x00
Protocol identifier	:	0x00
Length	:	0x00
Length	:	0x05
Unit identifier	:	0x01
Function code	:	0x10
Start address Hi	:	0x00
Start address Lo	:	0x6d
Nr. of register Hi	:	0x00
Nr. of register Lo	:	0x02

APPENDIX A

FLOATING POINT NOTATION

MINI CK 101 stores floating point data types using the IEEE single precision format. The format contains a sign bit, an exponent field and a fraction field or mantissa.

- The represented value

  the value of the number being represented is equal to the exponent multiplied by the fractional part with the sign specified by the bit sign field:

  $$(-1)^{sign} * (1.0+fraction) * s^{(exp-bias)}$$

  For detailed information, refer to the *ANSI IEEE Standard for Binary Floating Point Arithmetic.*

- Sign Bit

  The sign of the number being represented is stored in the sign bit. If the number is positive, the sign bit contains the value 0. If it is negative, it contains the value 1. The sign bit is stored in the most significant bit of a floating point value.

- Exponent Field

  Using an exponent increases the range of representable numbers. The exponent field of the number contains a 'biased' form of the exponent. A bias is subtracted from the exponent field, letting the actual exponent represent both positive and negative exponents. The value of this bias is hexadecimal 7F therefore the effective exponent (Rexp) of the number can be obtained as:

  Rexp = Exp - 7F

  Note

  If both the exponent field and the fraction field are equal to zero, the number being represented is zero.

- Fraction field (Mantissa)

  IEEE floating point format stores the fractional part of a number in a "normalized" form. It assumes that all nonzero numbers are of the following form:

  1.xxxxxxxx (binary)

  The character x represent either 0 or 1 (binary).
  Since all floating point numbers being with 1, the 1 becomes the implicit normalized bit. It is the most significant bit of the fraction and is not stored in memory. The binary point is located immediately to the right of the normalized bit. All bits after the binary point represent values less the 1 (binary).

Example:

The number 1.625 (dec) can be represented as:

1.101 (bin)

This number can be represented in decimal as:

$2^0 + 2^{-1} + 2^{-3}$ (dec)   Or   1 + 0.5 + 0.25

- Examples

some example has been added to help in the understanding of the rules explained above.

Ex 1.

The number 100.0 is represented as : 42 c8 00 00 (hex) or:

```
     0    1  0  0  0  0  1  0  1    1  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
     —    —  —  —  —  —  —  —  —    —  —  —  —  —  —  —  —  —  —  —  —  —  —  —  —  —  —  —  —  —
Bit  31   30                   23   22                16                                          0
```

The sign is positive (bit 31 is 0).
The Exponent Field is : 1 0 0 0 0 1 0 1 (bin), 85 (hex). The *exp* is : *exp* = 85(hex) - bias (7F hex) = 6.
Thus the first implicit bit to 1 has weight 6
At this point the mantissa can be represented in this way, with the weight of each bit.

```
        2^6   2^5 2^4 2^3 2^2 2^1 2^0 2^-1 2^-2 2^-3 ............
     1    1   0   0   1   0   0   0   0    0    0  ........... 0
     —    —   —   —   —   —   —   —   —    —    —  ........... —
Bi t Imp  22                                                   0
```

Now it is enough to sum the weight of the bits at 1.

Value = 2^6(imp) + 2^5 + 2^2 = 100.0

Ex 2.

Value = 0.15, binary representation is:

```
     0    0  1  1  1  1  1  0  0    0  0  1  1  0  0  1  1  0  0  1  1  0  0  1  1  0  0  1  1  0  1  0—
 — — — — — — — —    — — — — — — — — — — — — — — — — — — — — — — —
Bit  31   30                 23   22                                                              0
```

Sign = 0 positive
Exp = 7C hex - 7F hex = -3

Mantissa =

	2^{-3}	2^{-4}	2^{-5}	2^{-6}	2^{-7}	2^{-8}	2^{-9}	2^{-10}	....															
	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	1	0
Bit	Imp	22																						0

Value = $2^{-3} + 2^{-6} + 2^{-7} + 2^{-10} + 2^{-11}$ ...... = 0.15 (approx.)

Ex 3.

Value = -5.5, binary representation is:

	1	1	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bit	31	30							23	22																						0

Sign = 1 negative
Exp = 81hex - 7F hex = +2
Mantissa =

	2^{2}	2^{1}	2^{0}	2^{-1}	2^{-2}	2^{-3}	2^{-4}	2^{-5}	2^{-6}	2^{-7}	2^{-8}	2^{-9}	2^{-10}	....										
	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bit	Imp	22																						0

Value = 2^{2} (imp.) + 2^{0} + 2^{-1} = 5.5 (negative)