Thermo SCIENTIFIC

Ramsey
MINI CK100
Static Weight Indicator

PROFIBUS-DP Slave Protocol
Manual

MINI CK100
Part No.: Pbus

DOCUMENT HISTORY

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About this manual

The *PROFIBUS-DP Slave protocol* manual consists of three parts.

Chapter 1, is a brief overview of the PROFIBUS-DP protocol.

Chapter 2, explains how PROFIBUS-DP 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, is a 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

- PROFIBUS DIN 19245 Part 3 Order No. 0.012
- SPC3 Siemens PROFIBUS Controller
  User description 10.04.96 Order No. 6ES7 195-0BD00-8BA0

1. PROFIBUS OVERVIEW

1.1 Introduction to the PROFIBUS

The PROFIBUS born by the need to have an open, vendor independent communication system that allows to connect all the components used for the automation of technical processes.

The PROFIBUS is a standardized communication system, all its characteristics, rules and technical information are collected in the PROFIBUS DIN 19245 normative.

There are three main variation of PROFIBUS corresponding to the intended application: PROFIBUS-FMS , PROFIBUS-DP and PROFIBUS-PA.

1.2 The PROFIBUS-DP

This is the performance optimized version of PROFIBUS, specially dedicated to time-critical communication between automation system and distributed peripherals.

It is typically used to transfer I/O images between a main PLC and remote devices (normally sensors, actuators, transmitters). In this case it will be used to transfer (read and write) blocks of data also. PROFIBUS is a typical master/slave communication where the main PLC is the master and the remote devices are the slaves. It offers also the possibility to implement complex multi-master structures but this is not relevant for our purpose. The line is a 2 wires twinax cable, connection is EIA RS 485. Baud rate can be from 9,6 kbit/s up to 1,5 Mbit/s, length of the line is max 200 m at 1,5 Mbit/s extendible with repeaters.

1.3 Data Transfer

The interface between the Master and the Slave are structured in parameterization - configuration - and data transfer phase. In the parametrization and configuration phases each Slave compares its real configuration with the configuration data received from the Master. When verifying the configuration (device type, format and the length of information ...) has to be identical. This guarantees a protection against configuration fault. Only if these tests are successful the Slave can enter in the data exchange phase. Max number of data that it is possible to transfer at once in this phase is limited to 246 bytes (123 words).

1.4 Protection mechanisms

Besides the configuration check to avoid erroneous configurations, the Slave uses the Watch Dog control to detect failures on the bus. If a Slave recognizes no successful data transfer with the Master within the Watch Dog control interval, it generates an alarm condition.

2 IMPLEMENTATION ON THE MINICK 100

2.1 The 'PROFIBUS interface board'.

Connection to the PROFIBUS will be done through a dedicated optional board 'PROFIBUS interface board' provided with the SPC3 controller. The SPC3 is an integrated circuit produced by SIEMENS, it handles the interface with the Master up to 12 Mbit/s.
The PROFIBUS boards is provided by plug terminals 6 pin connector for RS485 connection. The board can be plugged into the instrument in the slot dedicated for the option. The software automatically will recognize it.

2.2 MINICK 100 configuration and test.

The slave address and the buffer dimensions should be defined on the instrument setup: 'MAIN MENU 5 - PROFIB scroll'.

Define here the address of the instrument in the PROFIBUS net.

- PROFIB SCROLL 1 - **Password: SERVICE**
Address
1
ENTER

Default:	*1*
Min	1
Max	126

In the next two scroll the user can define independently the read and write buffer dimensions. This possibility is very useful since it allows to reduce the address space to allocate the instrument to the minimum needed.
The dimension should be entered in number of words. This number includes also the header of the telegram (see Tab 2.1) that takes 4 words , so the minimum is 5 words.

- PROFIB SCROLL 2 - **Password: SERVICE**
Read buffer dim
48 words
ENTER

Default:	*48*
Min	5
Max	48

- PROFIB SCROLL 3 - **Password: SERVICE**
Write buffer dim
48 words
ENTER

Default:	*48*
Min	5
Max	48

In the TEST SCROLL it is possible to check the actual status of the communication.

- TEST SCROLL 8 - **Password: SERVICE**
Test communication B
19.2 kb Wait Prm

In the third line the baud rate and status are dynamically displayed. The status can be:

WAIT PRM	it is waiting for the PARAMETER message
WAIT CFG	it is waiting for the CONFIGURATION message
DATA EXC	it is in the DATA EXCHANGE phase , configuration and parametrization have been completed successfully.

The baud rate is automatically detected by the instrument, if the displayed value changes continuously it means that there are problems on the line or the CPU is OFF.

2.3 Data transfer

During the communication activity, the MINICK 100 will always act as Slave, meaning that it will respond to a request from a Master device on the line, but will never attempt to send messages out.

The PROFIBUS interface allows a remote intelligent device to read and write data from and to the instrument. Data is organized in registers, some of them are read only others write only groups.

The master has the possibility to perform two type of operations: write data and read data. The first simply consists in sending to the MINI CK100 the values to write in the registers together with indications to identify what registers have to be write. In the second case the procedure can be a little more complex since the reading operation can be proceeded by a write operation to tell to the MINI CK100 what registers should be read. Write and read operation are explained in detail below.

Write operations

A typical structure of the telegram for the *Writing* operation, is shown below

elem. #	register	type	offset (bytes)	note
1	Stamp	integer	0	See below
2	Slave Address	Single	1	According to the Instrument
3	Function	Single	2	Write 06 (Hex)
4	Register Address HI	Single	3	
5	Register Address LO	Single	4	
6	Data HI	Integer	5	If the register is a “floating point” type the register is doubled
7	Data LO	integer	6	If the register is a “floating point” type the register is doubled
8	Check Error	-	-	

Tab. 1

STAMP: information for Use

In the PROFIBUS protocol, data are transmitted continuously. So the same telegram is sent by the master to the slave more times. To avoid that the slave interprets continuously the same data (it would create problem also, for examples with the commands), the *stamp* is used. The slave interprets received data only if the stamp is different form the stamp received in the previous telegram. The master has only to change the stamp value when it create a new telegram. The stamp of the last interpreted telegram is re-transmitted by the instrument in the read buffer.

The '*Data*' section contains the data to write in the order MSB - LSB.

When the MINI CK 100 processes the 'package', before to write the received data in the registers, it checks that all the parameters are correct and the data to write do not overlaps specified max and min limit (each writeable register has own max and min limit, see table 3.1.).

If it detects errors the write operation fails, a DIAGNOSTICS message will be activated.

Read operations

A typical structure of the telegram for the *Reading* operation, is shown below

elem. #	register	type	offset (bytes)	note
1	Stamp	integer	0	See below
2	Slave Address	Single	1	According to the Instrument
3	Function	Single	2	Read 03 (Hex)
4	Register Address HI	Single	3	
5	Register Address LO	Single	4	
6	Data HI	Integer	5	If the register is a "floating point" type the register is doubled
7	Data LO	integer	6	If the register is a "floating point" type the register is doubled
8	Check Error	-	-	

Tab.2

In the PROFIBUS protocol the master continuously reads data from slave.

the MINI CK 100 will remember which registers have been required the last time and it will continue to update the read buffer with their actual values.

What the Master will receive after a read operation is a buffer of data having the same structure of the write telegram (see paragraph above).

2.4 Timings

The instrument updates almost all its basic variables (e.g. weight, rate, totals ...) each 100 milliseconds. With the same frequency the instrument updates the read buffer. If the master performs more communications in this period, it will receive more time the same data.
The write request are interpreted by the instrument in polling with a period of 100 milliseconds.

2.5. Communication errors

The alarm condition ‘PROFIBUS comm. error’ is activated by the instrument in two conditions:

- If the SPC3 controller installed on the ‘PROFIBUS interface board’ recognizes no successful data transfer within the watch dog control interval.

- If the received data contains errors (value overlaps limits, register number does not exist, group number does not exist ...)

The alarm can be defined as SHUT DOWN and the shut down digital output can be used to set the system in safety condition.

In the second case the instrument also activates an EXPANDED DIAGNOSTIC request to the master.

2.5.1. Diagnostics data

The Master system has the possibility to detect a ‘communication error’ condition by checking the diagnostics. In case of error the MT2000 will activate the request for diagnostic acquisition indicating that expanded device related diagnostics data are present.
When the master requires the diagnostics it will get:

Byte	Bit position								Diagnostics data
	7	6	5	4	3	2	1	0	
0									StatStatus1
1									StatStatus2
2									StatStatus3
3									MasterAdd
4									IdentNumberHigh
5									IdentNumberLow
6	0	0	0	0	0	0	1	0	Ext Diag - Header

7	0	0	0	0	GE	RE	LE	CE	Ext Diag - Data

Tab. 3 - Composition of the diagnostics data

GE	Group Error	Invalid group identifier, the group does not exist
RE	Register number Error	The number of requested registers is wrong
LE	Limits Error	A write operation has been performed but the value to write overlaps the limits.
CE	Coherency Error	The Master has tried to write or read partially a variable composed by more registers (e.g. only one word of a floating variable)

Refer to DIN 19245 Part 3 for details about the meaning of the first 5 bytes.

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 100 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:

CHAR variable	A char is a variable of 1 byte . It contains integer values in the ranges 0 to 255 or +127 to -128. The char variables can be structured in array with various dimensions.
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

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 always sends 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 Table 1: List of registers

Register	Type	Low Limit	High Limit	Refresh Time [ms]	Format	Address (word)	Note
Simulation Key	WO	(**)	(**)	-	integer	0	
Write flag	RO	-	(*)	-	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	

(*) 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 (16)	RO	-	-	200	integer	17	
Display (17)	RO	-	-	200	integer	18	
Display (18)	RO	-	-	200	integer	19	
Display (19)	RO	-	-	200	integer	20	
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	23	
Display (38)	RO	-	-	200	integer	38	
Display (39)	RO	-	-	200	integer	39	
Display (40	RO	-	-	200	integer	40	

Register	Type	Low Limit	High Limit	Refresh Time [ms]	Format	Address (word)	Note
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	
In / Out image	RO	-	-	100	Integer	47	
Commands	RW	0	0xffff	-	Integer	48	
Commands 1	RW	0	0xffff	-	Integer	49	
DYNAMIC DATA							
Net weight	RO	-	-	100	float	52	
Gross weight	RO	-	-	100	float	54	
Peak weight	RO	-	-	100	float	56	
Master total	RO	-	-	100	float	58	
Reset total	RO	-	-	100	float	60	
Master total double	RO	-	-	100	double	62	
Reset total double	RO	-	-	100	double	66	
Manual zero	RW	-	-	-	long	72	
Manual span	RW	-	-	-	float	74	

Register	Type	Low Limit	High Limit	Refresh Time [ms]	Format	Address (word)	Note
Linearization							
Linear option	RW	Tab.06	Tab.06	-	integer	78	
Linear weight 1	RW	0	SCALE CAP.	-	float	79	
Linear factor 1	RW	0	1.5	-	float	81	
Linear weight 2	RW	0	SCALE CAP.	-	float	83	
Linear factor 2	RW	0	1.5	-	float	85	
Linear weight 3	RW	0	SCALE CAP.	-	float	87	
Linear factor 3	RW	0	1.5	-	float	89	
Linear weight 4	RW	0	SCALE CAP.	-	float	91	
Linear factor 4	RW	0	1.5	-	float	93	
DISPLAY DATA MENU							
Units	RW	Tab.07	Tab.07	-	integer	97	
Weight units	RW	Tab.08	Tab.08	-	integer	98	
Total units	RW	Tab.09	Tab.09	-	integer	99	
Language	RW	Tab.10	Tab.10	-	integer	100	
Time format	RW	Tab.11	Tab.11	-	integer	101	
Date format	RW	Tab.12	Tab.12	-	integer	102	
Line 2	RW	Tab.13	Tab.13	-	integer	103	
Line 3	RW	Tab.14	Tab.14	-	integer	104	
Weight damping	RW	0	16	-	integer	105	
Tare mode	RW	Tab.15	Tab.15	-	integer	106	
SCALE DATA MENU							
Scale capacity	RW	1	1000000	-	float	109	
Scale div.	RW	Tab.16	Tab.16	-	integer	111	
Load cell nr.	RW	1	6	-	integer	116	
Load cell cap.	RW	1	500000	-	float	117	

Register	type	Low Limit	High Limit	Refresh Time [ms]	Format	Address (word)	Note
Load cell sens.	RW	0.5	3.36	-	float	119	
Load cell res1	RW	10	2000	-	float	121	
Load cell res2	RW	10	2000	-	float	123	
Load cell res3	RW	10	2000	-	float	125	
Load cell res4	RW	10	2000	-	float	127	
Load cell res5	RW	10	2000	-	float	129	
Load cell res6	RW	10	2000	-	float	131	
Motion band	RW	0	3	-	integer	134	
Motion band delay	RW	0	60	-	float	135	
CALIBRATION DATA MENU							
Calibrat. mode	RW	Tab.17	Tab.17	-	integer	139	
Test weights	RW	0	SCALE CAP.	-	float	140	
Rcal res	RW	10	1000000	-	long	142	
Rcal calcon	RO	-	-	-	float	144	
Rcal factor	RW	-99.99	+99.99	-	float	146	
Calibr. interval	RW	0	365	-	integer	148	
AZT option	RW	Tab.18	Tab.18	-	integer	149	
AZT range	RW	0	10	-	float	150	
AZT dev	RW	0	10	-	float	152	
AZT duration	RW	2	60	-	Integer	154	
PROTECTION LEVEL MENU							
Protection level	RW	0	2	-	Integer	157	
DIAGNOSTIC MENU							
AD gross	RO	-	-	100	long	158	
AD net	RO	-	-	100	Long	160	
Load cell zero	RW	0	10000	-	Integer	162	
Load cell span	RW	0	30000	-	Integer	163	

Register	type	Low Limit	High Limit	Refresh Time [ms]	Format	Address (word)	Note
Gain	RO	-	-	-	Integer	164	
Drift	RO	-	-	-	Long	165	
Drift reference	RO	-	-	-	Long	167	
Mech. tare	RO	-	-	-	Long	169	
Service password	RW	Tab.19	Tab.19	-	Integer	171	
Operator password	RW	Tab.20	Tab.20	-	Integer	176	
Software version	RO	-	-	-	Integer	181	
Analog output	RO	-	-	-	Float	187	
I/O DATA MENU							
Analog out assign	RW	Tab.21	Tab.21	-	Integer	189	
Analog out range	RW	Tab.22	Tab.22	-	Integer	190	
Analog out delay	RW	0	300	-	Integer	191	
Analog out damping	RW	0	16	-	Integer	192	
Digital input 1 assign	RW	Tab.23	Tab.23	-	Integer	193	
Digital input 2 assign	RW	Tab.23	Tab.23	-	Integer	194	
Digital input 3 assign	RW	Tab.23	Tab.23	-	Integer	195	
Digital input 4assign	RW	Tab.23	Tab.23	-	Integer	196	
Digital input 5 assign	RW	Tab.23	Tab.23	-	Integer	197	
Digital input 6 assign	RW	Tab.23	Tab.23	-	Integer	198	
Digital input 7 assign	RW	Tab.23	Tab.23	-	Integer	199	
Digital input 8 assign	RW	Tab.23	Tab.23	-	Integer	200	
Digital input 9 assign	RW	Tab.23	Tab.23	-	Integer	201	
Digital input 10 assign	RW	Tab.23	Tab.23	-	Integer	202	
Digital input 11 assign	RW	Tab.23	Tab.23	-	Integer	203	
Digital input 12 assign	RW	Tab.23	Tab.23	-	Integer	204	
Digital input 13 assign	RW	Tab.23	Tab.23	-	Integer	205	

Register	type	Low Limit	High Limit	Refresh Time [ms]	Format	Address (word)	Note
Digital input 14 assign	RW	Tab.23	Tab.23	-	Integer	206	
Digital input 15 assign	RW	Tab.23	Tab.23	-	integer	207	
Digital input 16 assign	RW	Tab.23	Tab.23	-	integer	208	
Digital output 1 assign	RW	Tab.24	Tab.24	-	integer	209	
Digital output 2 assign	RW	Tab.24	Tab.24	-	integer	210	
Digital output 3 assign	RW	Tab.24	Tab.24	-	integer	211	
Digital output 4 assign	RW	Tab.24	Tab.24	-	integer	212	
Digital output 5 assign	RW	Tab.24	Tab.24	-	integer	213	
Digital output 6 assign	RW	Tab.24	Tab.24	-	integer	214	
Digital output 7 assign	RW	Tab.24	Tab.24	-	integer	215	
Digital output 8 assign	RW	Tab.24	Tab.24	-	integer	216	
Digital output 9 assign	RW	Tab.24	Tab.24	-	integer	217	
Digital output 10 assign	RW	Tab.24	Tab.24	-	integer	218	
Digital output 11 assign	RW	Tab.24	Tab.24	-	integer	219	
Digital output 12 assign	RW	Tab.24	Tab.24	-	integer	220	
Digital output 13 assign	RW	Tab.24	Tab.24	-	integer	221	
Digital output 14 assign	RW	Tab.24	Tab.24	-	integer	222	
Digital output 15 assign	RW	Tab.24	Tab.24	-	integer	223	
Digital output 16 assign	RW	Tab.24	Tab.24	-	integer	224	
ALARM THRESHOLD MENU							
Threshold 1 option	RW	Tab.25	Tab.25	-	integer	227	
Threshold 1 set	RW	0	105	-	float	228	
Threshold 1 delay	RW	0	90	-	integer	230	
Threshold 1 hyst.	RW	0	105	-	float	231	
Threshold 1 mode	RW	Tab.26	Tab.26	-	integer	233	
Threshold 1 var	RW	Tab.27	Tab.27	-	integer	234	

Register	type	Low Limit	High Limit	Refresh Time [ms]	Format	Address (word)	Note
Threshold 2 option	RW	Tab.28	Tab.28	-	integer	237	
Threshold 2 set	RW	0	105	-	float	238	
Threshold 2 delay	RW	0	90	-	integer	240	
Threshold 2 hyst.	RW	0	105	-	float	241	
Threshold 2 mode	RW	Tab.29	Tab.29	-	integer	243	
Threshold 2 var	RW	Tab.30	Tab.30	-	integer	244	
Threshold 3 option	RW	Tab.31	Tab.31	-	integer	247	
Threshold 3 set	RW	0	105	-	float	248	
Threshold 3 delay	RW	0	90	-	integer	250	
Threshold 3 hyst.	RW	0	105	-	float	251	
Threshold 3 mode	RW	Tab.32	Tab.32	-	integer	253	
Threshold 3 var	RW	Tab.33	Tab.33	-	integer	254	
Threshold 4 option	RW	Tab.34	Tab.34	-	integer	257	
Threshold 4 set	RW	0	105	-	float	258	
Threshold 4 delay	RW	0	90	-	integer	260	
Threshold 4 hyst.	RW	0	105	-	float	261	
Threshold 4 mode	RW	Tab.35	Tab.35	-	integer	263	
Threshold 4 var	RW	Tab.36	Tab.36	-	integer	234	
ALARMS MENU							
Alarm define 1	RW	-	Tab. 37	-	integer	267	
Alarm define 2	RW	-	Tab. 37	-	integer	268	
Alarm define 3	RW	-	Tab. 37	-	integer	269	
Alarm define 4	RW	-	Tab. 37	-	integer	270	
Alarm define 5	RW	-	Tab. 37	-	integer	271	
Alarm define 6	RW	-	Tab. 37	-	integer	272	
Alarm define 7	RW	Tab. 21	Tab. 37	-	integer	273	

Register	type	Low Limit	High Limit	Refresh Time [ms]	Format	Address (word)	Note
Alarm define 8	RW	Tab. 21	Tab. 37	-	integer	274	
Alarm define 9	RW	Tab. 21	Tab. 37	-	integer	275	
Alarm define 10	RW	Tab. 21	Tab. 37	-	integer	276	
Alarm define 11	RW	Tab. 21	Tab. 37	-	integer	277	
Alarm define 12	RW	Tab. 21	Tab. 37	-	integer	278	
Alarm define 13	RW	Tab. 21	Tab. 37	-	integer	279	
Alarm define 14	RW	Tab. 21	Tab. 37	-	integer	280	
Alarm define 15	RW	Tab. 21	Tab. 37	-	integer	281	
Alarm define 16	RW	Tab. 21	Tab. 37	-	integer	282	
Alarm define 17	RW	Tab. 21	Tab. 37	-	integer	283	
Alarm define 18	RW	Tab. 21	Tab. 37	-	integer	284	
Alarm define 19	RW	Tab. 21	Tab. 37	-	integer	285	
Alarm define 20	RW	Tab. 21	Tab. 37	-	integer	286	
Alarm define 21	RW	Tab. 21	Tab. 37	-	integer	287	
Alarm define 22	RW	Tab. 21	Tab. 37	-	integer	288	
Alarm define 23	RW	Tab. 21	Tab. 37	-	integer	289	
Alarm define 24	RW	Tab. 21	Tab. 37	-	integer	290	
Alarm define 25	RW	Tab. 21	Tab. 37	-	integer	291	
Alarm define 26	RW	Tab. 21	Tab. 37	-	integer	292	
Alarm define 27	RW	Tab. 21	Tab. 37	-	integer	293	
Alarm define 28	RW	Tab. 21	Tab. 37	-	integer	294	
Alarm define 29	RW	Tab. 21	Tab. 37	-	integer	295	
Alarm define 30	RW	Tab. 21	Tab. 37	-	integer	296	
NET MENU							
I.P. Address	RW	0.0.0.0	254.255. 255.255	-	integer	299	

Register	type	Low Limit	High Limit	Refresh Time [ms]	Format	Address (word)	Note
Net Mask Address	RW	0.0.0.0	255.255. 255.255	-	integer	307	
Com. Variable Selection	RW	Tab.38	Tab.38	-	integer	315	
PROFIBUS MENU							
Slave Address	RW	1	126	-	integer	327	
Read Buffer Length	RW	5	48	-	integer	328	
Write Buffer Length	RW	5	48	-	integer	329	

Tab.4 Variable list

3.3 Description of Registers

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.

3.3.1 Display data

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 UP/DOWN KEY 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

3.3.2 Status & Diagnostic

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 Alarm (Alr) Led
PL1.03 Ready (Rdy) Led
PL1.02 Zero Led
PL1.01 Stab weight led
PL1.00 NET (tare) led

Status

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

Status 1 - Generals

15	14	13	12	11	10	NU	08	07	06	05	04	NU	NU	NU	00

S1.15 Cumulative shut down
S1.14 Cumulative Alarms
S1.13 Calibration running
S1.12 Weight stable
S1.11 Center of zero
S1.10 Tare acquired
S1.09 Not used
S1.08 Ready

S1.07 Threshold 1
S1.06 Threshold 2
S1.05 Threshold 3
S1.04 Threshold 4
S1.03 not used
S1.02 not used
S1.01 not used
S1.00 success flag

Status 2 - Free

NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU

S2.15 Free

S2.07 Free

S2.14 Free	S2.06 Free
S2.13 Free	S2.05 Free
S2.12 Free	S2.04 Free
S2.11 Free	S2.03 Free
S2.10 Free	S2.02 Free
S2.09 Free	S2.01 Free
S2.08 Free	S2.00 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	12	11	10	09	08	07	06	05	04	03	02	01	00

A1.15 Free	A1.07 WARM START
A1.14 CELL FAIL	A1.06 COLD START
A1.13 free	A1.05 PWD DURING CALIBRATION
A1.12 EPROM FAIL	A1.04 CAL. TIME ELAPSED
A1.11 THRESHOLD 1	A1.03 EXTERNAL ALARM 1
A1.10 THRESHOLD 2	A1.02 EXTERNAL ALARM 2
A1.09 THRESHOLD 3	A1.01 EXTERNAL ALARM 3
A1.08 THRESHOLD 4	A1.00 AZT OVER LIMIT

Alarms 2

NU	NU	NU	12	11	10	09	NU	NU	NU	NU	NU	NU	NU	NU	NU

A2.15 Free	A2.07 Free
A2.14 Free	A2.06 Free
A2.13 Free	A2.05 Free
A2.12 PROFIBUS COMM.ERROR	A2.04 Free
A2.11 CALIBRATION CHANGED	A2.03 Free
A2.10 DYN DATA LOST	A2.02 Free
A2.09 SETUP DATA LOST	A2.01 Free
A2.08 Free	A2.00 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	NU	NU	NU	NU	NU	05	04	03	02	01	00

C1.15 SAVE SETUP DATA
C1.14 Free
C1.13 Free
C1.12 Free
C1.11 Free
C1.10 Free
C1.09 Free
C1.08 Free
C1.07 Free
C1.06 Free
C1.05 CLEAR PEAK
C1.04 CLEAR RESET TOTAL
C1.03 UPDATE TOTALS
C1.02 RESET TARE
C1.01 SET TARE
C1.00 RESET ALARM

Reset Commands

When the instrument receives a 'Clear Reset total' or a 'Reset alarm' command, it executes the command for the scale :

Clear Reset total Clear the reset total register.

Reset Alarms Reset any pending alarm

Commands 1

NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	NU	00

C1.15 Free
C1.14 Free
C1.13 Free
C1.12 Free
C1.11 Free
C1.10 Free
C1.09 Free
C1.07 Free
C1.06 Free
C1.05 Free
C1.04 Free
C1.03 Free
C1.02 Free
C1.01 Free

C1.08 Free	C1.00 RESET INSTRUMENT

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.

3.3.3 Dynamic data

Net weight The instantaneous net weight in engineering units. .
Gross weight The instantaneous gross weight in engineering units. .
Peak weight The absolute highest value of the actual net weight .
Master Total The current value of the master Totalizer of the static indicator.
Reset Total The current value of the Reset Totalizer of the static indicator.
Master Total double The current value of the master Totalizer of the static indicator in double format
Reset Total double The current value of the Reset Totalizer of the static indicator 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.

3.3.4 Linearization

Linear option The enable option for linearization function.

SETTINGs	CODE
NO	00H
YES	01H

Tab 06 – Linearization option limits

Linear weight 1 This value is a known test weight(s) or a bin with pre-weighed material . Pressing the ACQuire soft key display the scale weight for the applied known weight for 1st step.

Linear factor 1 Linearization factor as applicable to the 1st weight zone .

Linear weight 2 This value is a known test weight(s) or a bin with pre-weighed material . Pressing the ACQuire soft key display the scale weight for the applied known weight for 2nd step.

Linear factor 2 Linearization factor as applicable to the 2nd weight zone .

Linear weight 3 This value is a known test weight(s) or a bin with pre-weighed material . Pressing the ACQuire soft key display the scale weight for the applied known weight for 3rd step.

Linear factor 3 Linearization factor as applicable to the 3rd weight zone .

Linear weight 4 This value is a known test weight(s) or a bin with pre-weighed material . Pressing the ACQuire soft key display the scale weight for the applied known weight for 4th step.

Linear factor 4 Linearization factor as applicable to the 4th weight zone .

3.3.5 Display Data

Units Code of the "Measure Units" displayed according the table below:

SETTINGs	CODE
METRIC	00H
ENGLISH	01H
MIXED	02H

Tab 07 – Measure units codes

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

SETTINGs	CODE
PERCENT %	00H
KG	01H
TONNES	02H
POUNDS	03H
TONS	04H
LTONS	05H

Tab 08 – Weight units code

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 09 – Total units code

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

SETTINGs	CODE
USA	00H
ITALIAN	01H

Tab 10 – Language units code

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

SETTINGs	CODE
24H	00H
12H	01H

Tab 11– Time format units code

Date Format Code of the setted “Date Format” according the table below:

SETTINGs	CODE
DD-MM-YYYY	00H
MM-DD-YYY	01H
YYYY-MM-DD	02H

Tab 12 – Date format units code

Line 2 Display Code of the setted “Line 3 Display” according the table below:

SETTINGs	CODE
NONE	00H
GROSS	01H
TARE	02H
PEAK	03H
RESET TOTAL	04H
MASTER TOTAL	05H
DATE & TIME	06H
BARGRAPH	07H

Tab 13 – Line 2 display format units code

Line 3 Display Code of the setted “Line 3 Display” according the table below:

SETTINGs	CODE
NONE	00H
GROSS	01H
TARE	02H
PEAK	03H
RESET TOTAL	04H
MASTER TOTAL	05H
DATE & TIME	06H
BARGRAPH	07H

Tab 14 – Line 3 display format units code

Weight Damping The Value in seconds of the displayed "Rate Damping".

Tare mode Select the mode to acquire the tare weight**:**

SETTINGs	CODE
ACQUIRED	00H
MANUAL	01H

Tab 15 – Tare mode units code

3.3.6 Scale Data

Scale Capacity The maximum weight of the indicator, entered by the user in the instrument setup. It is the reference value for the thresholds 1, 2, 3, 4 .

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 16 – Scale division code

Load Cell numbers The numbers of the load cells..

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

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

Motion Band Define the motion band for stable weight indication.

Motion band delay Define the motion delay for stable weight indication..

3.3.7 Calibration Data

Calibration Mode Code of the “Calibration mode” selected according the table below:

SETTINGs	CODE
R-CAL	00H
TEST CHAIN	01H

Tab 17– Calibration mode code

Test Weights The value in engineering units of the sample weight used for calibration.

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.

RCal Factor Number in percentage used to correct the “Calibration Constant” value to the real

Calibration Interval Number of selected days between two calibration.

Azt opt. The enable option for AZT function:

SETTINGs	CODE
NO	00H
YES	01H

Tab 18 – 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.

Azt Duration The value in engineering units of the azt duration time.

3.3.8 Diagnostic data

Protection Level Protection level of the instrument when password is entered.
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.
Gain Gain of the ADC converter
Drift Compensation value for thermic drift at runtime.
Drift reference Compensation value for thermic drift at calibration time.
Mechtare Mechanical tare value.
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 19- 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 20- Operator password limit

Software version Release of the Instrument firmware's.
Analog output Analog out value sameas shown in the diagnostic menu.

3.3.9 Analog & Digital I/O

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

SETTINGs	**CODE**
NONE	00H
NET WEIGHT	01H

GROSS WEIGHT	02H
TARE WEIGHT	03H
PEAK WEIGHT	04H

Tab 21 – Analog out assign limits

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 22 – Analog out range limits

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

Analog Out damping The value in second that the output takes for the stabilization after a status variation.(digital filter)

Digital inputs assign The digital inputs configuration.

INPUT ASSIGN NUMBERS	
MAX	2
MIN	0

Tab 23- Digital input assign numbers limits

Digital outputs assign The digital oputputs configuration.

OUTPUT ASSIGN NUMBERS	
MAX	5
MIN	0

Tab 24- Digital output assign numbers limits

3.3.10 Alarms

Threshold 1 opt. Enable the threshold 1 alarm condition.

SETTINGs	CODE
NO	00H
YES	01H

Tab 25 – Threshold 1 option limits

Threshold 1 set Set value for threshold 1 alarm condition.

Threshold 1 delay Delay time for threshold 1 alarm condition.

Threshold 1 hyst. Set value for threshold 1 hysteresis..

Threshold 1 mode Set value for threshold mode alarm condition :

SETTINGs	CODE
LOW WEIGHT	00H
HIGH WEIGHT	01H

Tab 26 – Threshold 1 mode limits

Threshold 1 var. Variable on which alarm 1 threshold is managed :

SETTINGs	CODE
NET WEIGHT	00H
GROSS WEIGHT	01H
ABS NET WEIGHT	02H
ABS GROSS WEIGHT	03H

Tab 27 – Threshold 1 var. limits

Threshold 2 opt. Enable the threshold 2 alarm condition.

SETTINGs	CODE
NO	00H
YES	01H

Tab 28 – Threshold 2 option limits

Threshold 2 set Set value for threshold 2 alarm condition.

Threshold 2 delay Delay time for threshold 2 alarm condition.

Threshold 2 hyst. Set value for threshold 2 hysteresis..

Threshold 2 mode Set value for threshold 2 mode alarm condition :

SETTINGs	CODE

LOW WEIGHT	00H
HIGH WEIGHT	01H

Tab 29 – Threshold 2 mode limits

Threshold 2 var. Variable on which alarm 2 threshold is managed :

SETTINGs	CODE
NET WEIGHT	00H
GROSS WEIGHT	01H
ABS NET WEIGHT	02H
ABS GROSS WEIGHT	03H

Tab 30 – Threshold 2 var. limits

Threshold 3 opt. Enable the threshold 3 alarm condition.

SETTINGs	CODE
NO	00H
YES	01H

Tab 31 – Threshold 3 option limits

Threshold 3 set Set value for threshold 3 alarm condition.

Threshold 3 delay Delay time for threshold 3 alarm condition.

Threshold 3 hyst. Set value for threshold 3 hysteresis..

Threshold 3 mode Set value for threshold 3 mode alarm condition :

SETTINGs	CODE
LOW WEIGHT	00H
HIGH WEIGHT	01H

Tab 32 – Threshold 3 mode limits

Threshold 3 var. Variable on which alarm 3 threshold is managed :

SETTINGs	CODE
NET WEIGHT	00H

GROSS WEIGHT	01H
ABS NET WEIGHT	02H
ABS GROSS WEIGHT	03H

Tab 33 – Threshold 3 var. limits

Threshold 4 opt. Enable the threshold 4 alarm condition.

SETTINGs	CODE
NO	00H
YES	01H

Tab 34 – Threshold 4 option limits

Threshold 4 set Set value for threshold 4 alarm condition.

Threshold 4 delay Delay time for threshold 4 alarm condition.

Threshold 4 hyst. Set value for threshold 4 hysteresis..

Threshold 4 mode Set value for threshold 4alarm condition :

SETTINGs	CODE
LOW WEIGHT	00H
HIGH WEIGHT	01H

Tab 35 – Threshold 4 mode limits

Threshold 4 var. Variable on which alarm 4 threshold is managed :

SETTINGs	CODE
NET WEIGHT	00H
GROSS WEIGHT	01H
ABS NET WEIGHT	02H
ABS GROSS WEIGHT	03H

Tab 36 – Threshold 4 var. limits

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 37 – Alarm define code

3.3.11 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 38– Variable selection range code

3.3.12 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.

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)

4.1 Read Operation Example (Function 03)

QUERY		**RESPONSE MESSAGE**	
Stamp	xxx	Stamp	xxx
Slave Address	xxx	Slave Address	xxx
Function	03H	Function	03H
Address. HI	xxx	Byte Count	xxx
Address. LO	xxx	Data MSB	xxx
N° Data HI	xxx	...	xxx
N° Data LO	xxx	Data LSB	xxx

EXAMPLE 1
The Host wants to receive the Net Weight :

Address of slave : 01
Register N°: 52 (34 Hex)
Type of register: Float
Load value: 100,0 Kg

HOST (PLC)				**SLAVE (MINI CK)**	
Stamp	3AH	→			
Slave Address	01H				
Function	03H				
Address HI	00H				
Address LO	34H				
N° Data HI	00H				
N° data LO	02H	→			
			←	3AH	Stamp
				01H	Slave Address
				03H	Function
				04H	Byte Count
				42H	Data Hi
				C8H	Data Lo
				00H	Data Hi
				00H	Data Lo

EXAMPLE 2
The Host wants to receive the Scale Division Settings :

Address of slave :	01
Register N°:	111 (6F Hex)
Type of register:	integer
Division:	0,05

HOST (PLC)				**SLAVE (MINI CK)**	
Stamp	3AH	→			
Slave Address	01H				
Function	03H				
Address HI	00H				
Address LO	6FH				
N° Data HI	00H				
N° Data LO	01H	→			
			←	3AH	Stamp
				01H	Slave Address
				03H	Function
				02H	Byte Count
				00H	Data Hi
			←	09H	Data Lo

4.2 *Write Operation Example*

SINGLE REGISTER(1 Word – Function 06)

QUERY		**RESPONSE MESSAGE**	
Stamp	xxx	Stamp	xxx
Slave Address	xxx	Slave Address	xxx
Function	06H	Function	06H
Address. HI	xxx	Address. HI	xxx
Address. LO	xxx	Address. LO	xxx
Preset Data HI	xxx	Preset Data HI	xxx
Preset Data LO	xxx	Preset Data LO	xxx

EXAMPLE 1

The Host wants to select (write) the language of the Instrument :

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

HOST (PLC)				**SLAVE (MINI CK)**	
Stamp	3AH	→			
Slave Address	01H				
Function	06H				
Address HI	00H				
Address LO	64H				
Preset Data HI	00H				
Preset Data LO	01H	→			
			←	3AH	Stamp
				01H	Slave Address
				06H	Function
				00H	Address HI
				64H	Address LO
				00H	Preset Data HI
				01H	Preset Data LO

MULTIPLE REGISTERS (Functuion 16)

QUERY		RESPONSE MESSAGE	
Stamp	xxx	Stamp	xxx
Slave Address	xxx	Slave Address	xxx
Function	10H	Function	10H
Start Address. HI	xxx	Start Address. HI	xxx
Start Address. LO	xxx	Start Address. LO	xxx
N° of Registers HI	xxx	N° of Registers HI	xxx
N° of Registers LO	xxx	N° of Registers LO	xxx
Byte Count	xxx		
Data Hi	xxx		
Data Lo	xxx		
Data Hi	xxx		
Data Lo	xxx		

EXAMPLE 1

The Host 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 Kg

HOST (PLC)				SLAVE (MINI CK)	
Stamp	3AH	→			
Slave Address	01H				
Function	10H				
Start Address. HI	00H				
Start Address. LO	06D				
N° of Registers HI	00H				
N° of Registers LO	02H				
Byte Count	04H				
Data Hi	00H				
Data Lo	00H				
Data Hi	42H				
Data Lo	C8H	→			
			←	3AH	Stamp
				01H	Slave Address
				10H	Function
				00H	Start Address HI
				6DH	Start Address LO
				00H	N° of Registers HI HI
				02H	N° of Registers LO

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 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)

APPENDIX B

INSTRUMENT CONFIGURATION: THE “**GSD”** FILE

Profibus devices have different performances characteristics. Features differ in regards to available functionality or possible bus parameters such as baud rate and time monitoring. These parameters vary individually for each device type and vendor. For this reason the PROFIBUS Organization has standardized a database file, it contains all the characteristics of the PROFIBUS device and must be delivered by the vendor together with the device. This file has a name that depends by the vendor and an extension that is normally GSD but can be different depending by the country of origin of the device. The third letter of the extension in fact defines the country:

D	-	Default, is valid for each country
I	-	Italian
G	-	German
E	-	English
F	-	French
P	-	Portuguese
S	-	Spanish

Refers to the manual of the device you are using as Master of your PROFIBUS network to get information about how to use the GSD file.

These are the main PROFIBUS characteristics of the Ramsey MINI CK 101 instruments.

Vendor	Ramsey
Model	MINICK101
Ident number	0x2101
Protocol	Standard DP
Baud rate supported	from 9.6 kb to 12 Mb
Freeze Mode supp	NO
Sync Mode supp	NO
Auto Baud supp	YES
Set Slave Add_supp	NO
Station Type	Compact
Prm Data Length	7
Diag Data Length	8
Config Data Length	9
Input data length (write buffer)	5-48 word, coherency over word
Output data length (read buffer)	5-48 word, coherency over word

To change I/O data length

The instrument gives the possibility to define the write and read buffer dimensions. Default values are 48 words for both, if the user changes them he should also modify the GSD file so that the configuration in the instrument setup and in the file corresponds.
To make it is easy. The GSD file should be edited with a normal text editor and the value at the directive 'module =' at the bottom of the file should be changed. It normally appears as follows:

Module = "MINICK101" 0xC0,0x6F,0x6F

The first value (0xC0) should be left unchanged, the second value specifies the dimension of the write buffer, the third of the read buffer.

The value to set should be computed as follows:

Read_Buffer_Dim = 63 + RBD
Write_Buffer_Dim = 63 + WBD

where:

RBD is the read buffer dimension defined in the instrument setup.
WBD is the write buffer dimension defined in the instrument setup.

The value should be then converted and written in hexadecimal notation.

The meaning of the default values 0x6F is:

6F hex = 111 dec = 63 + 48

48 is the default dimension of the buffers.

Instruction are also contained in the GSD file.

Follows the contents of the Ramsey MINICK101 GSD file.

R_MINICK101.GSD :

```
#Profibus_DP
GSD_Revision          = 1
;
Vendor_Name           = "Ramsey"
Model_Name            = "MINICK101
Revision              = "Rev.A”
Ident_Number          = 0x2105
Protocol_Ident        = 0
Station_Type          = 0
FMS_supp              = 0
Hardware_Release           = "Rev.A"
Software_Release      = "86.GSD.01"
;
9.6_supp              = 1
19.2_supp             = 1
93.75_supp            = 1
187.5_supp            = 1
500_supp              = 1
1.5M_supp             = 1
3M_supp               = 1
6M_supp               = 1
12M_supp              = 1
;
MaxTsdr_9.6           = 60
MaxTsdr_19.2          = 60
MaxTsdr_93.75         = 60
MaxTsdr_187.5         = 60
MaxTsdr_500           = 100
MaxTsdr_1.5M          = 150
MaxTsdr_3M            = 250
MaxTsdr_6M            = 450
MaxTsdr_12M           = 800
;
Redundancy       = 0
Repeater_Ctrl_Sig     = 0
24V_Pins              = 0
Implementation_Type   = "ifak"
Bitmap_Device         = "dev.dib"
Bitmap_Diag           = "diag.dib"
Bitmap_SF             = "sf.dib"
;
Freeze_Mode_supp      = 0
Sync_Mode_supp        = 0
Auto_Baud_supp        = 1
Set_Slave_Add_supp    = 0
Min_Slave_Intervall   = 12
```

;

```
Modular_Station             = 0
Modul_Offset                = 1
Max_User_Prm_Data_Len= 7
;
Fail_Safe                   = 0
Slave_Family                = 5
Max_Diag_Data_Len           = 8
;
Unit_Diag_Bit(0)    = "Coherency Error"
Unit_Diag_Bit(1)    = "Limits Error"
Unit_Diag_Bit(2)    = "Register Number Error"
Unit_Diag_Bit(3)    = "Group ID Error"
;
;-------------------------------------------------------
;
; Buffers dimension
;
; Standard buffer dimension is :           48 words read buffer  (0x6F)
;                                          48 words write buffer (0x6F)
;
; Dimensions can be changed by modifing the last two value in the
; 'Module' definition below.
; The value should be obtained as follows:
;
;       63 + WB_WN       or       63 + RB_WN
;
; where WB_WN is the wished words number for the write buffer, RB_WN is
; the wished words number for the read buffer.;
: The value should be converted in hexadecimal format. Default value
; hex 6F corresponds to:
;
;       63 + 48    ->   111 dec  ->   6F hex
;
; WB_WN and RB_WN values must be entered also in the instrument setup
; in decimal format.
;
;                   Write buffer ----+   +---- Read buffer
;                                    |   |
;                                    V   V
;
Module = "MT2000" 0xC0,0x6F,0x6F
1
EndModule
```