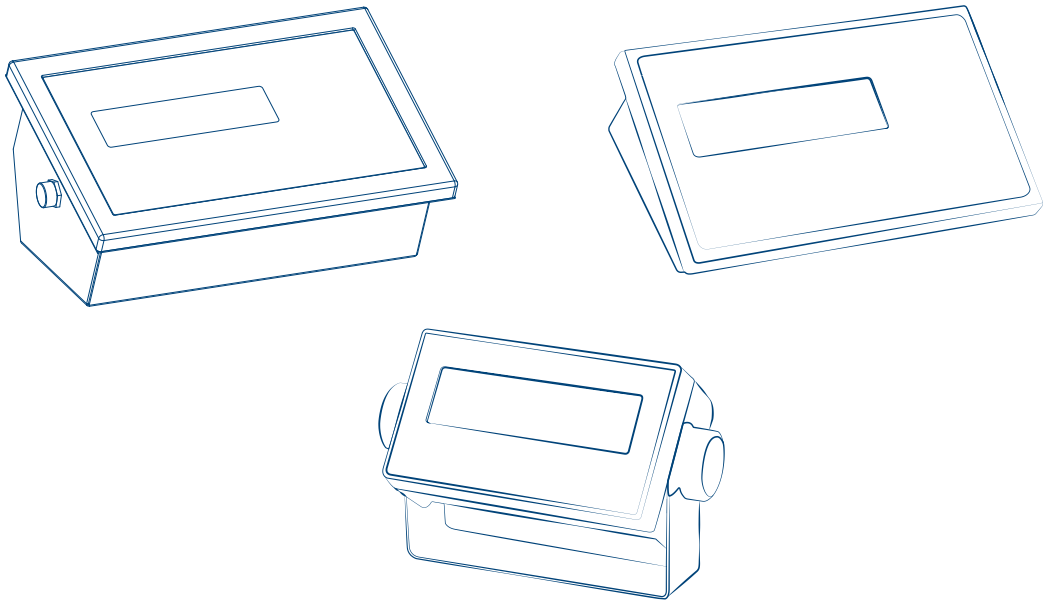
DINI ARGEO
Scales - Weighing systems
A RICE LAKE WEIGHING SYSTEMS COMPANY

MODBUS PROTOCOL

For DFW series indicators

TECHNICAL MANUAL **ENGLISH**



Modbus

For models:

DFWIECEX
DFWL-10
DFWLI-10

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Modbus Functions

Function	Description
01 (0x01)	Coil reading
03 (0x03)	Holding data Area registers reading
04 (0x04)	Input Area registers reading
05 (0x05)	Single coil writing
06 (0x06)	Single register writing
15 (0x0F)	Several coils writing
16 (0x10)	Several registers writing

Functions 01, 03, 04 - Coil / Register Reading

Query:	Add	01 / 03 / 04	00	00	00	02	CRC / LRC
	Address Modbus	Function	Starting address 00 = 30001 (input) 40001 (holding) 1 (coil)		Number of registers to read		Error control (2 bytes)

Response:	Add	01 / 03 / 04	04	xx	xx	xx	xx	CRC / LRC
	Address Modbus	Function	No. of Bytes	Data value				Error control (2 bytes)

Functions 05, 06 - Single Coil / single Register writing

Query:	Add	05 / 06	00	00	xx	xx	CRC / LRC
	Address Modbus	Function	Register address 00 = 40001 (holding) 1 (coil)		Value to write		Error control (2 bytes)

Response:	Add	05 / 06	04	00	xx	xx	CRC / LRC
	Address Modbus	Function	Register address		Written value		Error control (2 bytes)

Functions 15, 16 - Several Coils / Registers writing

Query:	Add	0F / 10	00	00	00	02	04	xx	xx	xx	xx	CRC / LRC
	Address Modbus	Function	Starting address 00 = 30001 (input) 40001 (holding) 1 (coil)		Number of registers / coils to write		No. of Bytes to be written	Value to write in the first register		Value to write in the second register		Error control (2 bytes)

Response:	Add	0F / 10	00	00	00	02	CRC / LRC
	Address Modbus	Function	Starting address		Number of registers / coils modified		Error control (2 bytes)

Error control

CRC (CYCLICAL REDUNDANCY CHECK)

In RTU transmission mode the messages include an error control field based on a CRC method, calculated as follows:

1. Load the value 0xFFFF into a 16bit register (called CRC).
2. Perform the exclusive OR operation between the first byte of the message and the least significant byte of the CRC register.
3. Shift the CRC register one position to the right, a 0 is entered in place of the MSB. The LSB is extracted and examined.
4. If LSB = 0 ➜ repeat point 3.
   If LSB = 1 ➜ Perform the exclusive OR operation between the CRC register and the value 0xA001.
5. Repeat steps 3 and 4 until 8 shifts have been performed.
6. Repeat steps 2 to 5 for the next byte of the message.
7. The least significant byte must be transmitted first, followed by the most significant byte.

LRC (LONGITUDINAL REDUNDANCY CHECK)

In ASCII transmission mode the messages include an error control field based on a LRC method, calculated as follows:

1. Add together all the bytes of the message, excluding the first character (: or ;) and the final CRLF, within an 8-bit field. In this way the carryovers are discarded.
2. Subtract the value obtained from 0xFF, thus obtaining the complement to 1.
3. Add 1 to obtain the complement to 2.
4. The most significant byte must be transmitted first, followed by the least significant byte.

Communication speed

The reading frequency depends on the number of queried registers and which ones they are. The standard frequency is 25-30 Hz. A reading frequency of **110 Hz** can be achieved by reading only these registers in a single frame:

30001	Gross weight
30002	
30003	Net weight
30004	
30005	Input status register

or

40001	Gross weight
40002	
40003	Net weight
40004	
40005	Input status register

Examples

READING OF REGISTER 30005 (INPUT STATUS REGISTER)

Query:	A	04	00	04	00	01	CRC / LRC
	Address Modbus	Function	Starting address (30005)		Number of registers to read		Error control (2 bytes)

Response:	01	04	02	xx	xx	CRC / LRC	
	Address Modbus	Function	No. of Bytes	Data value		Error control (2 bytes)	

READING OF REGISTERS 30001, 30002 (GROSS WEIGHT)

Query:	A	04	00	00	00	02	CRC / LRC
	Address Modbus	Function	Starting address (30001)		Number of registers to read		Error control (2 bytes)

Response:	01	04	04	xx	xx	xx	xx	CRC / LRC
	Address Modbus	Function	No. of Bytes	Data value				Error control (2 bytes)

WRITING OF REGISTERS 40001, 40002, 40003 (SEND MANUAL TARE COMMAND WITH VALUE 1000 kg)

Query:	A	10	00	00	00	03	06	00	03	00	00	03	E8	CRC / LRC
	Address Modbus	Function	Starting address (40001)		Number of registers / coils to write		No. of Bytes to be written	Command manual tare		Parameter 1 0x03E8 = 1000				Error control (2 bytes)

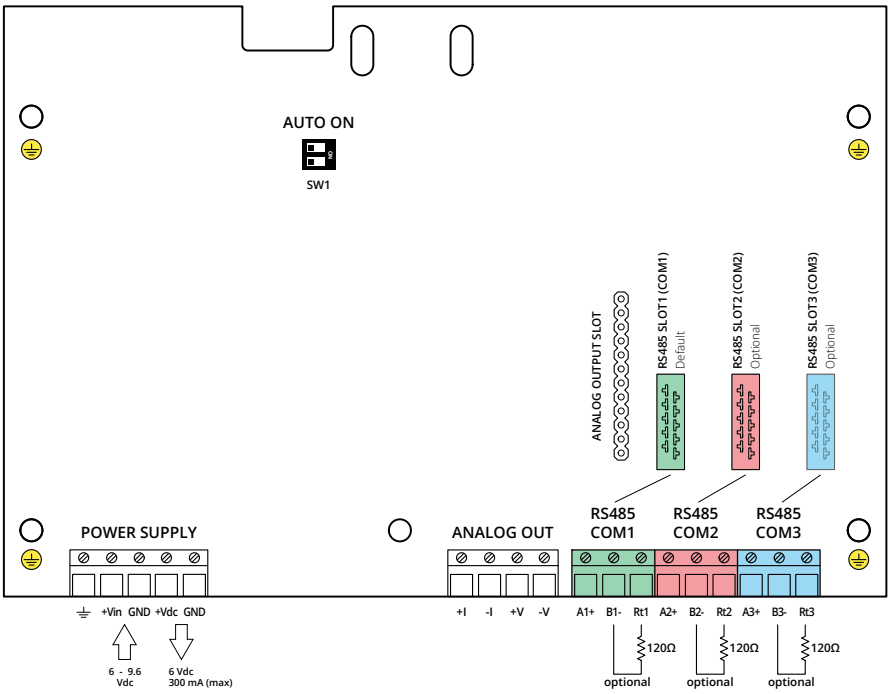
Response:	01	10	00	00	00	03	CRC / LRC
	Address Modbus	Function	Starting address		Number of registers modified		Error control (2 bytes)

WRITING OF REGISTER 40001 (SEND ZERO COMMAND)

Query:	Add	06	00	00	00	01	CRC / LRC
	Address Modbus	Function	Register address (40001)		Zero command (01)		Error control (2 bytes)

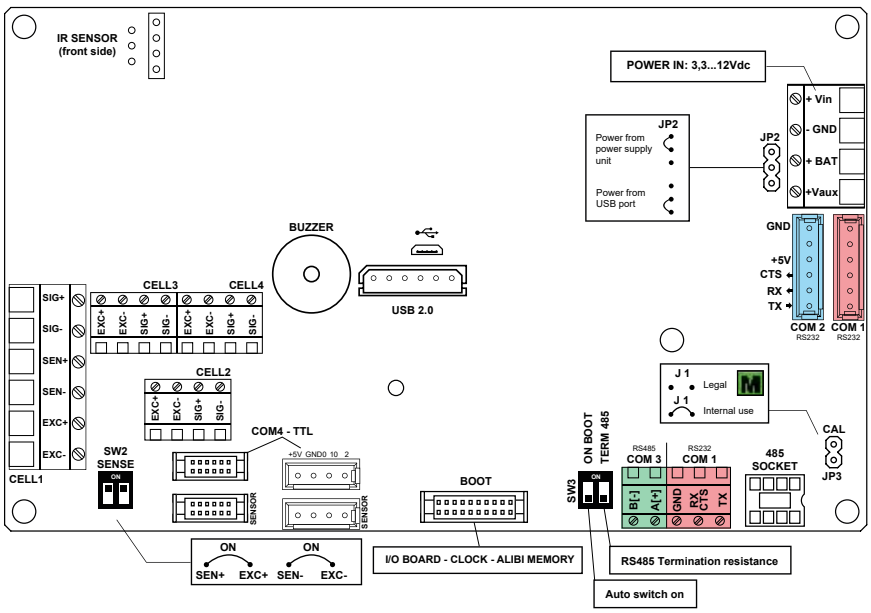
Response:	Add	06	00	00	00	01	CRC / LRC
	Address Modbus	Function	Register address		Written value		Error control (2 bytes)

DFWIECEX



The connection is made via one of the **RS485** ports on the instrument.

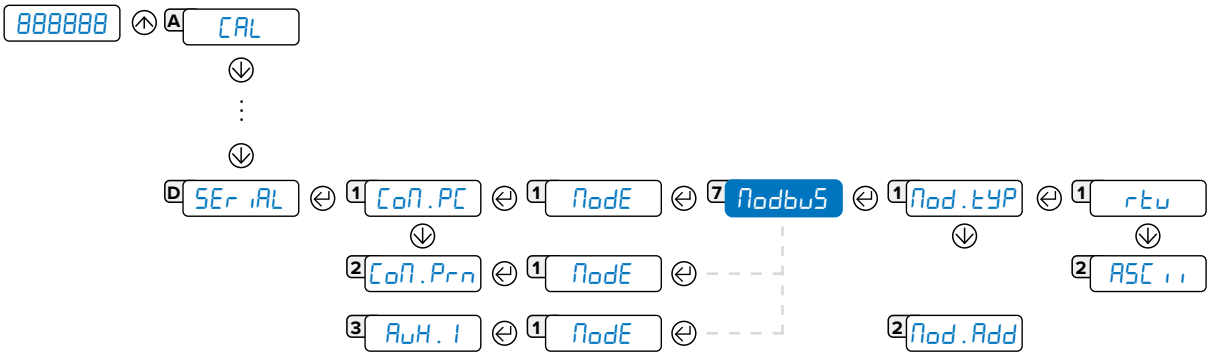
DFWL-10 / DFWLI-10



The connection is made via one of the serial port of the instrument:

- **COM1: RJ11 connector**
- **COM2: internal** (only DFWLI-10)
- **COM3: internal** (only DFWLI-10)

Selection of Modbus protocol



1. Select the *ModbuS* transmission mode in the *ModE* parameter.

2. Select the type of transmission *ASC ii* / *rtu* in the parameter *Mod.tYP*.

3. Set the Modbus address (0–98) of the transmitter in the parameter *Mod.Add*.

Data Reading (Input Area)

- The available data are divided into registers.
- Each register consists of 2 Bytes.

Register	Name
30001	Gross weight.
30002	
30003	Net weight.
30004	
30005	Input status register (see Tab. 1 page 11).
30006	Command status register (see Tab. 3 page 12).
30007	Output status register (see Tab. 2 page 11).

...

30101	Firmware release.
30102	
30103	ADC points channel 1
30104	ADC points channel 2
30105	ADC points channel 3
30106	ADC points channel 4

30111	µV channel 1
30112	µV channel 2
30113	µV channel 3
30114	µV channel 4
30115	Analog output current value (DAC).
30116	Calibration status (see page 27)
30117	Analog output current value (V, 1 decimal).
30118	Analog output current value (mA, 1 decimal).
30121	Type-approval status (0 = not type-approved / 1 = type-approved).
30122	Serial number.
30123	
30124	Weight percentage channel 1 (2 decimals)
30125	Weight percentage channel 2 (2 decimals)
30126	Weight percentage channel 3 (2 decimals)
30127	Weight percentage channel 4 (2 decimals)
30128	Pre-calibration status (0 = not pre-calibrated / 1 = pre-calibrated).
30129	Setup size (in byte).
30132	Firmware name (characters 1, 2).
30133	Firmware name (characters 3, 4).
30134	Firmware name (characters 5, 6).
30135	Firmware name (characters 7, 8).
30136	ADC point zero value
30137	
30144	Indicator status (see Tab. 6 on page 13)
30145	Theoretical ADC points per mV/V
30146	

Tab.1 - **Input Status Register**

Bit	Description	Bit meaning	
		0	1
15	Not used.		
14			
13			
12	Endian.	Big Endian	Little Endian
11	Not used.		
10			
9	Input 2 (if available).	Deactivated	Activated
8	Input 1 (if available).	Deactivated	Activated
7	Gross weight equal to 0.	No	Yes
6	Manual tare condition.	No	Yes
5	Tare condition entered.	No	Yes
4	Overload condition.	No	Yes
3	Underload condition.	No	Yes
2	Weight stability.	No	Yes
1	Gross weight polarity.	+	-
0	Net weight polarity.	+	-

Tab.2 - **Output Status Register**

Bit	Description	Bit meaning	
		0	1
15	Not used.		
14			
13			
12			
11	Relay 12 (if available). (only DFWIECEX)	Not energized	Energized
10	Relay 11 (if available). (only DFWIECEX)	Not energized	Energized
9	Relay 10 (if available). (only DFWIECEX)	Not energized	Energized
8	Relay 9 (if available). (only DFWIECEX)	Not energized	Energized
7	Relay 8 (if available). (only DFWIECEX)	Not energized	Energized
6	Relay 7 (if available). (only DFWIECEX)	Not energized	Energized
5	Relay 6 (if available).	Not energized	Energized
4	Relay 5 (if available).	Not energized	Energized
3	Relay 4 (if available).	Not energized	Energized
2	Relay 3 (if available).	Not energized	Energized
1	Relay 2 (if available).	Not energized	Energized
0	Relay 1 (if available).	Not energized	Energized

Tab.3 - **Command Status Register**

Bit	Description	Bit meaning
15	Last command received.	
14		
13		
12		
11		
10		
9		
8		
7	Result of last command received:	0 = Command correct and executed. 1 = Incorrect command. 2 = Incorrect command data. 3 = Command not allowed. 4 = Command non-existent.
6		
5		
4		
3	Processed command count.	Value in module 16.
2		
1		
0		

Tab.4 - **Alibi Status Register**

Bit	Description	Bit meaning	
		0	1
15	Not used.		
14			
13			
12			
11	Type of tare.	Semi-automatic	Manual
10	Not used.		
9			
8			
7	Number of rewrites.	From 0 to 255 rewrites.	
6			
5			
4			
3			
2			
1			
0			

Tab.5 - **Output functions**

0 = No function.
1 = Setpoint on gross weight.
2 = Setpoint on net weight.
4 = Gross weight on zero.
5 = Net weight on zero.
6 = Weight in motion.
23 = PRINT key pressed.
25 = MODE key pressed.
26 = Key C pressed.
27 = ZERO key pressed.
28 = TARE key pressed.
29 = Error.
30= Setpoint on net weight if a tare is set.

Tab.6 - **Indicator status**

0 = Weighing
1 = Numeric entry
2 = Setup
3 = Boot
4 = TxRx Setup
5 = Serial test
6 = Print test
7 = Firmware update
8 = Stand-by
9 = Auto-zero
10 = Change channel
11 = Digital input test
12 = Exclude scheduler
13 = Warm-up

Values on the grey lines can be ignored.

Coil Data Area

Read and write data area, consisting of 6 coils of 1 bit each.

Register	Name	Bit meaning	
		0	1
1	Digital output 1.	Output not active.	Output active.
2	Digital output 2.	Output not active.	Output active.
3	Digital output 3.	Output not active.	Output active.
4	Digital output 4.	Output not active.	Output active.
5	Digital output 5.	Output not active.	Output active.
6	Digital output 6.	Output not active.	Output active.
7	Digital output 7.	Output not active.	Output active.
8	Digital output 8.	Output not active.	Output active.
9	Digital output 9.	Output not active.	Output active.
10	Digital output 10.	Output not active.	Output active.
11	Digital output 11.	Output not active.	Output active.
12	Digital output 12.	Output not active.	Output active.

Reading and Writing Data (Holding Data Area)

Register	Name
40001	Gross weight.
40002	
40003	Net weight.
40004	
40005	Input Status Register (see Tab. 1 page 11).
40006	Command Status Register (see Tab. 3 page 12).
40007	Output status register (see Tab. 2 page 11).

Weights and Setpoints

Register	Name
40101	Gross weight.
40102	
40103	Net weight.
40104	
40105	Tare.
40106	
40107	Input Status Register (see Tab. 1 page 11).
40108	Output Status Register (see Tab. 2 page 11).
40109	Setpoint 1 ON temporary.
40110	
40111	Setpoint 2 ON temporary.
40112	
40113	Setpoint 3 ON temporary.
40114	
40115	Setpoint 4 ON temporary.
40116	
40117	Setpoint 5 ON temporary.
40118	
40119	Setpoint 6 ON temporary.
40120	
40121	Setpoint 1 OFF temporary.
40122	
40123	Setpoint 2 OFF temporary.
40124	
40125	Setpoint 3 OFF temporary.
40126	
40127	Setpoint 4 OFF temporary.
40128	
40129	Setpoint 5 OFF temporary.
40130	
40131	Setpoint 4 OFF temporary.
40132	

Register	Name
40133	Setpoint 1 ON permanent.
40134	
40135	Setpoint 2 ON permanent.
40136	
40137	Setpoint 3 ON permanent.
40138	
40139	Setpoint 4 ON permanent.
40140	
40141	Setpoint 5 ON permanent.
40142	
40143	Setpoint 6 ON permanent.
40144	
40145	Setpoint 1 OFF permanent.
40146	
40147	Setpoint 2 OFF permanent.
40148	
40149	Setpoint 3 OFF permanent.
40150	
40151	Setpoint 4 OFF permanent.
40152	
40153	Setpoint 5 OFF permanent.
40154	
40155	Setpoint 6 OFF permanent.
40156	

Commands

Register	Name
40231	Command Status Register (see Tab. 3 page 12).
40232	Command (see list of commands page 26).
40233	Parameter 1.
40234	
40235	Parameter 2.
40236	
40237	Parameter 3.
40238	

Alibi

Register	Name	
40251	Alibi gross weight.	
40252		
40253	Alibi tare weight.	
40254		
40255	ID.	
40256		
40257	Alibi Status Register (see Tab. 4 page 12).	
40258	Alibi memory availability.	0 = OK.
		1 = Alibi mode not selected.
		2 = Alibi memory not present.
		3 = Alibi memory not initialised.
		4 = Alibi memory empty.

Setup

Register	Name
43001	Word 1.
...	
45048	Word 2048.

Calibration

Register	Name
40901	Number of calibration points.
40902	Calibration weight 1.
40903	
40904	Calibration weight 2.
40905	
40906	Calibration weight 3.
40907	
40908	ADC value at zero.
40909	
40910	ADC value of calibration point 1.
40911	
40912	ADC value of calibration point 2.
40913	
40914	ADC value of calibration point 3.
40915	

Metrological Data

Register	Name	
40951	Unit of measure.	0 = g
		1 = kg
		2 = t
		3 = lb
40952	Division 1.	
40953	Division 2.	
40954	Decimals.	
40955	Range 1.	
40956		
40957	Range 2.	
40958		

Filter

Register	Name	
40959	Filter Index (see example on page 30).	
40960	Custom filter rate.	Active only if Custom filter is selected.
40961	Win custom filter.	
40962	Avg custom filter.	
40963	Pit custom filter.	

Metric Parameters

Register	Name	
40964	Auto zero.	0 = Disabled.
		1 = Enabled.
40965	Auto zero percentage.	
40966	Zero key percentage.	
40967	Zero tracking divisions.	
40968	Stability divisions.	
40969	Calibration zone G.	
40970	Zone of use G.	

40974	Zero tracking time.	(100-5000ms)
40975	Stability detection time.	(10-10000ms)
40976	Additional stability detection filter.	(0-2000ms, 0 disabled)

Anti-peak filter

Register	Name
41021	Locking divisions (PA.LA.dU).
41022	Lock time (PA.LA.tM, 0.01 s).
41023	Unlocking divisions (PA.d iU).
41024	Division interval (PA.bn.dU).
41025	Peak locking time (PA.t iME, 0.01 s).

Send the **28** (0x1C) **"SAVE SETUP" command to save these settings.**

Advanced filters

Register	Name
41001	Filter ID 1
41002	Filter value 1
41003	Filter ID 2.
41004	Filter value 2.
41005	Filter ID 3.
41006	Filter value 3.

ID	Filter	Value
1	Raw	Frequency, 1 decimal (value 30 indicates 3.0 Hz)
4	Selective	Frequency, 1 decimal (value 500 indicates 50 Hz)
5	End	Percentage, 2 decimal places (value 100 indicates 10%)

Send the **36** (0x24) **"WRITE AND SAVE DATA" command with parameter 1 equal to 0 to save these settings.**

Tare and Modbus ID configuration

Register	Name	
40981	Tare configuration.	0 = Disabled.
		1 = Locked.
		2 = Unlocked.
40982	Modbus ID.	0–98.
40984	Operating mode	
40985	Not used.	
40986		
40987		
40988		
40989		
40990	Conversion factor (unit 2)	in fixed-point integer, 5 decimal places.
40991		

Send the **28** (0x1C) **"SAVE SETUP" command to save these settings.**

Weights and Setpoints on 1 word

Register	Name
41101	Gross weight.
41102	Net weight.
41103	Tare.
41104	Input Status Register (see Tab. 1 page 11).
41105	Output Status Register (see Tab. 2 page 11).
41106	Setpoint 1 ON temporary.
41107	Setpoint 2 ON temporary.
41108	Setpoint 3 ON temporary.
41109	Setpoint 4 ON temporary.
41110	Setpoint 5 ON temporary.
41111	Setpoint 6 ON temporary.
41112	Setpoint 1 OFF temporary.
41113	Setpoint 2 OFF temporary.
41114	Setpoint 3 OFF temporary.
41115	Setpoint 4 OFF temporary.
41116	Setpoint 5 OFF temporary.
41117	Setpoint 6 OFF temporary.
41118	Setpoint 1 ON permanent.
41119	Setpoint 2 ON permanent.
41120	Setpoint 3 ON permanent.
41121	Setpoint 4 ON permanent.
41122	Setpoint 5 ON permanent.
41123	Setpoint 6 ON permanent.
41124	Setpoint 1 OFF permanent.
41125	Setpoint 2 OFF permanent.
41126	Setpoint 3 OFF permanent.
41127	Setpoint 4 OFF permanent.
41128	Setpoint 5 OFF permanent.
41129	Setpoint 6 OFF permanent.

Configuration of Inputs, Outputs

Register	Name	
41601	Input 1 function.	0 = No function. 1 = ZERO key pressed. 2 = TARE key pressed. 3 = MODE key pressed. 4 = PRINT key pressed. 5 = Key C pressed. 6 = Off. 7 = Disabling keypad.
41602	Input 2 function.	
41603	Input 3 function.	
41604	Input 4 function.	
41605	Output 1: Function.	See Tab. 5 page 13.
41606	Output 1: Type of contact (NO/NC).	
41607	Output 1: Switching condition (direct / stability).	
41608	Output 1: Hysteresis (disabled / enabled).	
41612	Output 2: Function.	See Tab. 5 page 13.
41613	Output 2: Type of contact (NO/NC).	
41614	Output 2: Switching condition (direct / stability).	
41615	Output 2: Hysteresis (disabled / enabled).	
41619	Output 3: Function.	See Tab. 5 page 13.
41620	Output 3: Type of contact (NO/NC).	
41621	Output 3: Switching condition (direct / stability).	
41622	Output 3: Hysteresis (disabled / enabled).	
41626	Output 4: Function.	See Tab. 5 page 13.
41627	Output 4: Type of contact (NO/NC).	
41628	Output 4: Switching condition (direct / stability).	
41629	Output 4: Hysteresis (disabled / enabled).	
41633	Output 5: Function.	See Tab. 5 page 13.
41634	Output 5: Type of contact (NO/NC).	
41635	Output 5: Switching condition (direct / stability).	
41636	Output 5: Hysteresis (disabled / enabled).	
41640	Output 6: Function.	See Tab. 5 page 13.
41641	Output 6: Type of contact (NO/NC).	
41642	Output 6: Switching condition (direct / stability).	
41643	Output 6: Hysteresis (disabled / enabled).	

Analog output configuration (DAC values) - (only DFWIECEX)

Register	Name
41647	Analog output function.
41648	Not used.
41649	
41650	Weight 1 value.
41651	
41652	DAC weight 1 value.
41653	Weight 2 value.
41654	
41655	DAC weight 2 value.
41656	Weight 3 value.
41657	
41658	DAC weight 3 value.

Analog output configuration (V values) - (only DFWIECEX)

Register	Name
41693	Underload V value.
41694	Weight 1 value.
41695	
41696	V weight 1 value.
41697	Weight 2 value.
41698	
41699	V weight 2 value.
41700	Weight 3 value.
41701	
41702	V weight 3 value.
41703	Overload V value.

Analog output calibration (V)

Register	Name
41801	DAC value at 0 V.
41802	DAC value at 10 V.

Analog output configuration (mA values) - (only DFWIECEX)

Register	Name
41737	Underload mA value.
41738	Weight 1 value.
41739	
41740	mA weight 1 value.
41741	Weight 2 value.
41742	
41743	mA weight 2 value.
41744	Weight 3 value.
41745	
41746	mA weight 3 value.
41747	Overload mA value.

Analog output calibration (mA)

Register	Name
41803	DAC value at 0 mA.
41804	DAC value at 20 mA.

Commands

COMMAND	DESCRIPTION	PARAMETER 1	PARAMETER 2
0 (0x00)	No command.	*Use this command before repeating the same command twice.*	
1 (0x01)	Zero.	-	0 (0x00) = stability check. 1 (0x01) = immediate zero.
2 (0x02)	Tare.	-	0 (0x00) = stability check. 1 (0x01) = immediate tare.
3 (0x03)	Manual tare.	Tare value.	-
10 (0x0A)	Writing setpoint 1.	Output activation “threshold” weight.	Output deactivation “threshold” weight.
11 (0x0B)	Writing setpoint 2.	Output activation “threshold” weight.	Output deactivation “threshold” weight.
12 (0x0C)	Writing setpoint 3.	Output activation “threshold” weight.	Output deactivation “threshold” weight.
13 (0x0D)	Writing setpoint 4.	Output activation “threshold” weight.	Output deactivation “threshold” weight.
14 (0x0E)	Writing setpoint 5.	Output activation “threshold” weight.	Output deactivation “threshold” weight.
15 (0x0F)	Writing setpoint 6.	Output activation “threshold” weight.	Output deactivation “threshold” weight.
25 (0x19)	Sets the relay status. (the relays must have the function: 0 “No function”).	• Status bitmask of the relays to be enabled *(bit 0 = relay 1, bit 1 = relay 2, bit 2 = relay 3, bit 3 = relay 4).* • DAC analog output.	If = 0: Parameter 1 refers to relays. If = 1: Parameter 1 refers to the analog output.
28 (0x1C)	Save setup.	-	-
30 (0x1E)	Read Alibi memory.	Rewrite number.	Weighing operation alibi ID.
31 (0x1F)	Saving a weighing operation in the Alibi memory.	-	-
34 (0x22)	Restart instrument.	-	-
35 (0x23)	Data reading.	-	-
36 (0x24)	Write and save data.	Parameter 1 = 0 (0x00) for saving data.	-
37 (0x25)	Calibration point acquisition.	0 (0x00) = Zero point 1 (0x01) = First point 2 (0x02) = Second point 3 (0x03) = Third point.	-
38 (0x26)	Cancel current calibration.	-	-
39 (0x27)	Zero calibration.	-	-
40 (0x28)	Enabling / Disabling keypad.	0 (0x00) = disabled. 1 (0x01) = enabled.	-
55 (0x37)	Disabling a peripheral.	0 (0x00) = disables the digital outputs (parameter 2). 1 (0x01) = disables the analog output (parameter 2).	Bit 0 = 1 disables relay 1 / analog output. Bit 1 = 1 disables relay 2.
60 (0x3C)	Modbus ID setting.	Serial number of the instrument.	Bit 0–3 = ID. Bit 4–7 = 1 to save the data.
65 (0x41)	Serial baud rate setting.	Baud rate index: 0 = 1200 1 = 2400 2 = 4800 3 = 9600 4 = 19200 5 = 38400 6 = 57600 7 = 115200	-
66 (0x42)	Theoretical calibration.	See par. “Theoretical calibration” on page 28)	

Calibration procedure by Modbus

1. Send command **35** (0x23) **“DATA READING”**.

2. If necessary, modify the metrological data registers (40951–40970).

3. Set the number of calibration points and the weight value of the calibration points in registers 40901–40907.

4. Check the correct progress of calibration in register 30116.

0	CALIBRATION NOT STARTED
1	ACQUISITION IN PROGRESS
2	ACQUISITION OK
3	ACQUISITION ERROR
4	CALIBRATION OK
5	CALIBRATION ERROR
6	ZERO CALIBRATION IN PROGRESS

5. Unload the scale and send command **37** (0x25) **“CALIBRATION POINT ACQUISITION”** with parameter 1 equal to 0 to acquire the calibration zero point. In register 30116, the calibration status changes to **ACQUISITION IN PROGRESS** and, if it then changes to **ACQUISITION OK**, it is possible to proceed (if instead it changes to **ACQUISITION ERROR** the point has not been acquired, send command **38** (0x26) **“CANCEL CALIBRATION”** and try to acquire the point again. Check that the weight is stable).

6. Load the scale with the first sample weight and send command **37** (0x25) **“CALIBRATION POINT ACQUISITION”** with parameter 1 equal to 1 to acquire the first calibration point. In register 30116, the calibration status changes to **ACQUISITION IN PROGRESS** and, if it then changes to **ACQUISITION OK**, it is possible to proceed (if instead it changes to **ACQUISITION ERROR** the point has not been acquired, send command **38** (0x26) **“CANCEL CALIBRATION”** and start again from step 5. Check if the weight is stable, and check that the µV are greater than the zero point).

Repeat step 6 for each calibration point (the number of calibration points has been set in register 40901).

7. Use command **36** (0x24) **“WRITE AND SAVE DATA”** with parameter 1 equal to 0 to save the calibration.
The calibration status changes to CALIBRATION **OK** (if it changes to **CALIBRATION ERROR** the calibration was not successful. Send command **38** (0x26) **“CANCEL CALIBRATION”** and start again from step 5.

Theoretical calibration

1. Write the parameter registers:

Registers 40233-40234 (PARAMETER 1): total load cell capacity. Decimals of the scale.
Registers 40235-40236 (PARAMETER 2): load cell sensitivity (*). 5 decimals.
Registers 40237-40238 (PARAMETER 3): mechanical tare value (if not known, enter value 0). Decimals of the scale + 1.

2. Send command **66** (0x42) "**THEORETICALCALIBRATION**".

3. Save the parameters by sending command **28** (0x1C) "**SAVE SETUP**".

(*) If several load cells are connected via a junction box/equalisation box, enter the average value:

$$\frac{(\text{mV/V cell 1}) + (\text{mV/V cell 2}) + (\text{mV/V cell 3}) + \ldots + (\text{mV/V cell n})}{n}$$

Example:
Theoretical calibration of a 4-cell platform.
Total capacity = 2000kg Mechanical tare weight = 55 kg
Sensitivity: cell 1 = 2.01032 cell 2 = 1.99420 cell 3 = 1.98846 cell 4 = 2.00375

Register	Value
40232	66 (0x42)
40233	2000 (0x07D0)
40234	
40235	199918 (0x00030CEE) (1.99918)
40236	
40237	550 (0x0226) (55.0)
40238	

Send the command **1** (0x01) **“ZERO”**.

Note: This command does not affect calibration. When the instrument is switched off the zeroing is lost.

- Send the command **35** (0x23) **“DATA READING”**.
- Send the command **39** (0x27) **“ZERO CALIBRATION”**.
- Check that the value in register 30116 changes from 6 (0x06) “Zero calibration in progress” to 2 (0x02) “Acquisition ok”.
- Give the command **36** (0x24) **“WRITE AND SAVE DATA”** entering the value 0 in PARAMETER 1 (0x00). Check that the value in register 30116 changes from 2 (0x02) “Acquisition ok” to 4 (0x04) “Calibration ok".

Note: Unlike the ZERO command, the ZERO CALIBRATION command acts on the calibration of the scale and makes the change of the zero point definitive.

The filters available are the following and can be set by modifying the register 40959, entering the index of the filter to be set. Before reading the value in the register, give the command **35** (0x23) **"DATA READING"** (register 40001).

CONTENTS	FILTER	DESCRIPTION
0	F 1	Filter at 5 Hz
1	F 2	Filter at 10 Hz
2	F 3	Filter at 20 Hz
3	F 4	Filter at 40 Hz
4	F 5	Filter at 80 Hz
5	F 6	Filter at 160 Hz
6	F 7	Filter at 325 Hz
7	F 8	Filter at 650 Hz (*)
8	F 9	Filter at 1300 Hz (*)
9	F 10	Filter at 2600 Hz (*)

(*) Not available when using multiple channels.

Then give the command **36** (0x24) **"WRITE AND SAVE DATA"** to save the change (register 40001).

It is possible to make a **complete backup** of the system by copying the content of the registers 43001–45048.

To **restore** the setup:
Write the data previously copied in registers 43001–45048.
Then give the command **28** (0x1C) **"SAVE SETUP"** (register 40001)

Saving or reading a weighing operation in the Alibi memory

To save a weighing operation in the Alibi memory give the command **31** (0x1F) **"SAVE IN ALIBI MEMORY"**.

To read a weighing operation saved in the Alibi memory give the command, with parameter 1 equal to the rewrite number and parameter 2 equal to the ID number.

E.g. Reading of the weighing operation with ID = 131071 and rewrite number 00255.

Register	Value	Description
40001	31	Command READ ALIBI MEMORY.
40002	0	Rewrite number = 255.
40003	255	
40004	1	ID number = 131071 (0x1FFFF).
40005	65535	

MODBUS calibration

Calibration of a scale with 4 cells with a capacity of 50 kg, division 2 g (0.002 kg), only one calibration point (besides zero) with a weight of 20 kg.

1. Use the command **35** (0x23) **"DATA READING"** with parameter 1 equal to 0 (dependent channels).

Register	Value	Description
40001	35	DATA READING command.
40002	00	Parameter 1 = 0 because the system has dependent channels.
40003	00	

2. Set the correct values in the registers for the metrological data.

Register	Value	Description
40901	1	Number of calibration points.
40902	0	Calibration weight
40903	20000	
40951	1	Unit of measure (kg = 1).
40952	2	Division 1.
40953	0	Division 2.
40954	3	Decimals.
40955	0	Range 1 (value to be entered without considering the decimal point).
40956	50000	
40957	0	Range 2.
40958	0	

3. Unload the scale and give the command **37** (0x25) **"CALIBRATION POINT ACQUISITION"** with parameter 1 equal to 0 to acquire the calibration zero.

Register	Value	Description
40001	37	Command CALIBRATION POINT ACQUISITION.
40002	0	Parameter 1 = 0 to acquire the zero point.
40003	0	

30116	X	Check that the value is 2 before proceeding (see calibration procedure on page 27).

4. Load the scale with the sample weight and give command **37** (0x25) **"CALIBRATION POINT ACQUISITION"** with parameter 1 equal to 1 to acquire the first calibration point.

Register	Value	Description
40001	37	Command CALIBRATION POINT ACQUISITION.
40002	0	Parameter 1 = 1 to acquire the first calibration point.
40003	1	

30116	X	Check that the value is 2 before proceeding (see calibration procedure on page 27).

5. Give command **36** (0x24) **"WRITE AND SAVE DATA"** with parameter 1 equal to 0 to save the changed parameters and the calibration. Check that the value in register 30116 changes from 2 (0x02) "Acquisition ok" to 4 (0x04) "Calibration ok".

Output setting

Example of setting output 1 with setpoint on gross weight, contact normally open, direct switching condition, no hysteresis, positive sign, no switching delay and enabled for 10 s.

Register	Value	Description
41605	1	1 = Setpoint on gross.
41606	0	NO.
41607	0	Direct switching condition.
41608	0	Hysteresis disabled.
41609	0	Positive sign.
41610	0	No communication delay.
41611	100	Activation time in tenths of a second.

Input setting

Example of setting input 1 to disable the keypad and input 2 to carry out tare.

Register	Value	Description
41601	7	7 = Disabling keypad.
41602	2	2 = Simulation of the tare key.

Analog output setting (only DFWIECEX)

Example of analog output configuration for operation on gross weight at 4–20 mA.
Using 3 calibration points at 0 kg, 50 kg, 100 kg. *(the values used are indicative)*

1. SELECTING THE OPERATING MODE:

Register	Value	Description
41647	1	0: analog output disabled. 1: analog output on gross weight. 2: analog output on net weight.

2. CALIBRATING THE ANALOG OUTPUT (V / mA)

Register	Value	Description
41801	0	DAC value at 0 V.
41802	63300	DAC value at 10 V.

41803	0	DAC value at 0 mA.
41804	58200	DAC value at 20 mA.

3. ASSOCIATING AN OUTPUT VALUE (OR ADC POINTS) WITH THE WEIGHT:

	Value (mA)	Description
41737	0	Output for underload (0 mA).
41738	0	Weight 1 (0 kg).
41739		
41740	40	Output for weight 1 (4.0 mA).
41741	50	Weight 2 (50 kg).
41742		
41743	120	Output for weight 2. (12.0 mA).
41744	100	Weight 3 (100 kg).
41745		
41746	200	Output for weight 3. (20.0 mA)
41747	200	Output for overload. (20.0 mA)

DINI ARGEO
Scales - Weighing systems
A RICE LAKE WEIGHING SYSTEMS COMPANY

HEAD OFFICE
Via Della Fisica, 20
41042 Spezzano di Fiorano, Modena - Italy
Tel. +39 0536 843418 - Fax +39 0536 843521

SERVICE ASSISTANCE
Via Dell'Elettronica, 15
41042 Spezzano di Fiorano, Modena - Italy
Tel. +39 0536 921784 - Fax +39 0536 926654

www.diniargeo.com

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