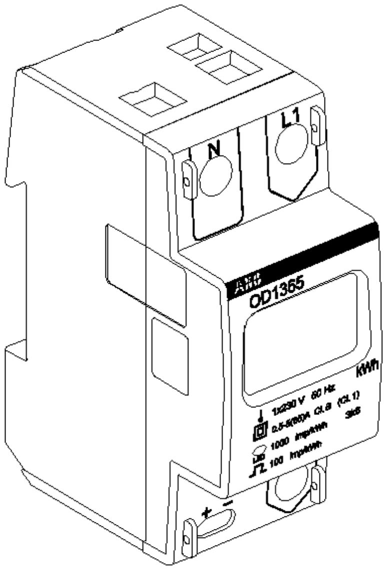

ODINsingle User's Manual

Rev A

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TABLE OF CONTENTS

1 GENERAL

This manual contains information about the ODINsingle, which is a family of electronic electricity meters manufactured by ABB AB.

The purpose of this manual is to give the user a good overview and understanding of the many functions and features the ODINsingle offers. It also describes general metering aspects. The end goal is to help the user to use the meter in the most optimal and correct way and to give the proper service and support to maintain the highest stability and lifetime.

The degree of the ODINsingle functions is controlled by its hardware (electronic boards, mechanics, etc), software (resided in a small computer inside the meter) and the meter type specific programming done when it is produced (stored in a non-volatile EEPROM memory).

Features (both hardware and software) which are not standard (incorporated in all meters) are pointed out in the manual as options.

WARNING! The voltages connected to the ODINsingle are dangerous and can be lethal. Therefore it must be insured that the terminals are not touched during operation. When installing the ODINsingle all voltages must be switched off.

2 PRODUCT DESCRIPTION

This chapter contains a description of the basic functions and practical handling of the ODINsingle. Functionality regarding communication is described in chapter 6.

2.1 FAMILY OVERVIEW

General Presentation
ODINsingle is an electronic electricity meter for single phase metering. As option the meter has a pulse output and reset possibilities of one of two energy registers. The setting is done with push button or via communication. ODINsingle is intended for mounting on a DIN rail and is designed in accordance with the ABB ProM standard.

General Features
ODINsingle is an active energy, single phase meter for direct metering up to 65A. The LCD display has 6 digits, 6 mm high to ensure easy reading.

ODINsingle is made compact, only 2 modules to save space in the installation.

A red LED at the front flashes proportionally to the energy consumed.

ODINsingle has a temperature range from –25 to +55º C (storage +70º C).

Communication
ODINsingle has 3 ways to communicate depending on type.

- Display at front
- Pulse output (option)
- IR interface for serial communication (together with serial communication adapter)

Button
The ODINsingle with reset functionality (option) has one user button that can be sealed by mounting the ODINsingle in a modular enclosure.

The button can be used to reset the energy and to view the total energy.

Type Approval
ODINsingle meter types are tested and approved according to IEC 62052-11 and 62053-21.
Measurement instrument directive (MID), category B, electrical environmental class E2 and electrical environmental class M1 EN 50470-1, EN 50470-3 category B.
These standards cover all technical aspects of the meter like climate conditions, electromagnetic compatibility (EMC), electrical requirements, mechanical requirements and accuracy.

2.2 METER PARTS

The different parts of the meter are depicted below, accompanied by a short description of each part.

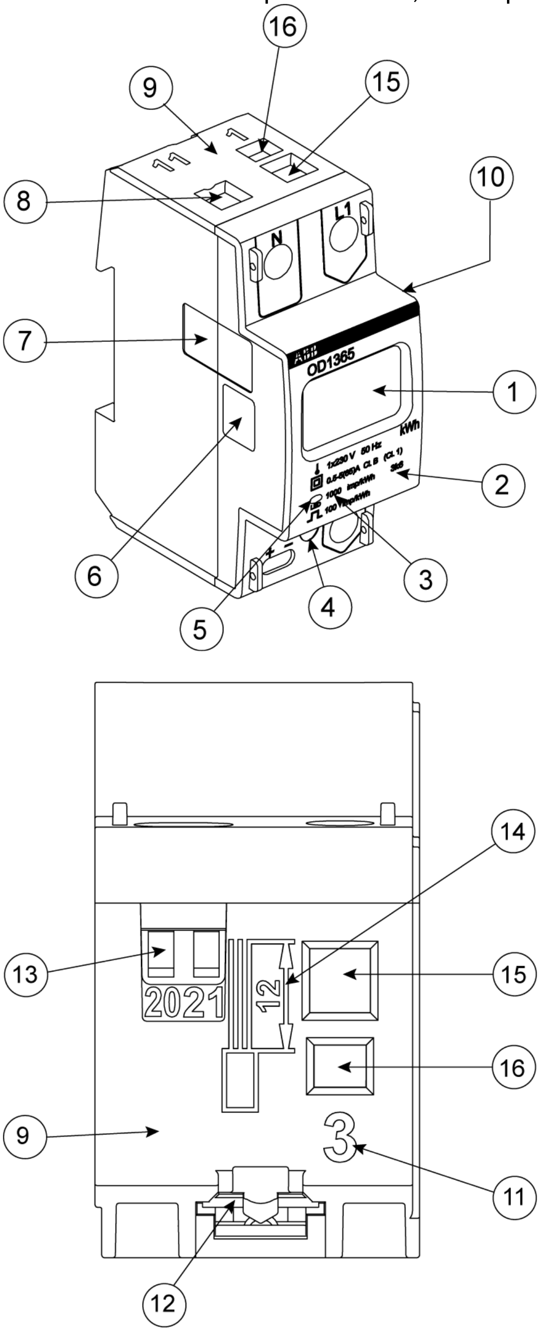


Fig. 2-1 Meter parts

-Position 1: LCD
A 6-digit Liquid Crystal Display.

-Position 2: Product information

-Position 3 and 5: LED and LED frequency
The meter has a red Light Emitting Diode that flashes in proportion to the consumed energy.

-Position 4: Button (option)
The button can be used to reset the energy and to change display mode.

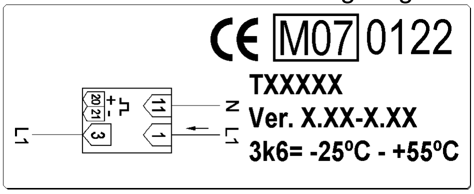
-Position 6: Optical port
For use of external communication devices.

-Position 7: Sealing tape
A piece of tape sealing the meter, which will leave traces on the meter in case it is broken.
It also serves as identification of our Accredited Laboratory for initial verification of the meter.

-Position 8: Neutral terminal
Made for stranded and flexible cables.

-Position 9: Voltage and current terminals
The voltage and current measured by the meter is connected here.

-Position 10: Label with wiring diagram for the terminals and placement for approval marks



-Position 11: Numbering of terminals

-Position 12: DIN-rail lock
Used for fixing the meter on the DIN-rail.

-Position 13: Pulse output (option)
Terminals for pulse output.

-Position 14 Stripping length
Showing the stripping length of the cables.

-Position 15: Phase terminals
Made for stranded and flexible cables.

-Position 16: Phase terminals
Made for busbar system.

2.3 METER TYPES

The ODINsingle product family is divided into two types:

- Direct connected meters up to 65A
- Direct connected meters up to 65A, with reset and pulse output

The meter type is reflected on the product marking, see figure below.

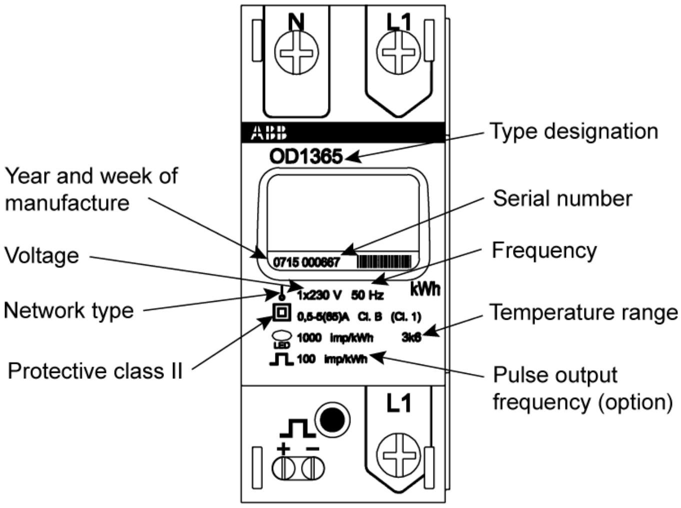


Fig. 2-2 Product label

A meter is identified by its type designation. For explanation of the positions in the type designation see further down in this chapter.

2.3.1 NETWORK TYPE

The network type symbol tells the number of measurement elements the meter contains. One voltage and one current is measured and used in the energy measurement.

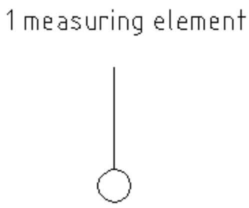


Fig. 2-3 Network symbol

The meter is used in single phase metering system with 2 wires

2.3.2 TYPE DESIGNATION

ODINsingle

Pos	1-2	3	4	5-6
Base				
ODIN meter family	OD			
Network type				
Single phase		1		
Functionality				
IR-port			0	
Pulse output, Reset, IR-port			3	
Maximum current				
65A. Direct connected				65

2.4 ENERGY INDICATOR

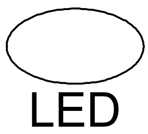


Fig. 2-4 Energy indicator

The red LED (Light Emitting Diode) on the front is an indicator that flashes in proportion to the energy. Every pulse means that a certain amount of energy has been registered, that is, it has a certain energy pulse frequency. This frequency is marked on the front of the meter.

2.5 BUTTON (OPTION)

The ODINsingle with reset functionality (option) has one user button that can be sealed by mounting the ODINsingle in a modular enclosure.

The button can be used to reset the energy and to change display mode, see chapter 2.7.

Note: There is always a time out time (10 seconds). If the button is not pressed during this time the ODINsingle meter steps back to Normal mode (the different modes are described in chapter 2.7).

2.6 DISPLAY INFORMATION

From the display it is possible to view information about the energy consumption, error status etc.

The display has 6 characters of 7-segment type with a height of 6 mm and a number of other specific segments to display different status information. The illustration below shows all segments (forming characters and symbols) that can appear on the display in different display modes.

Note: In every mode, the energy continues to be measured, the energy registers are updated and the meter generates pulses.

2.6.1 DISPLAY OVERVIEW

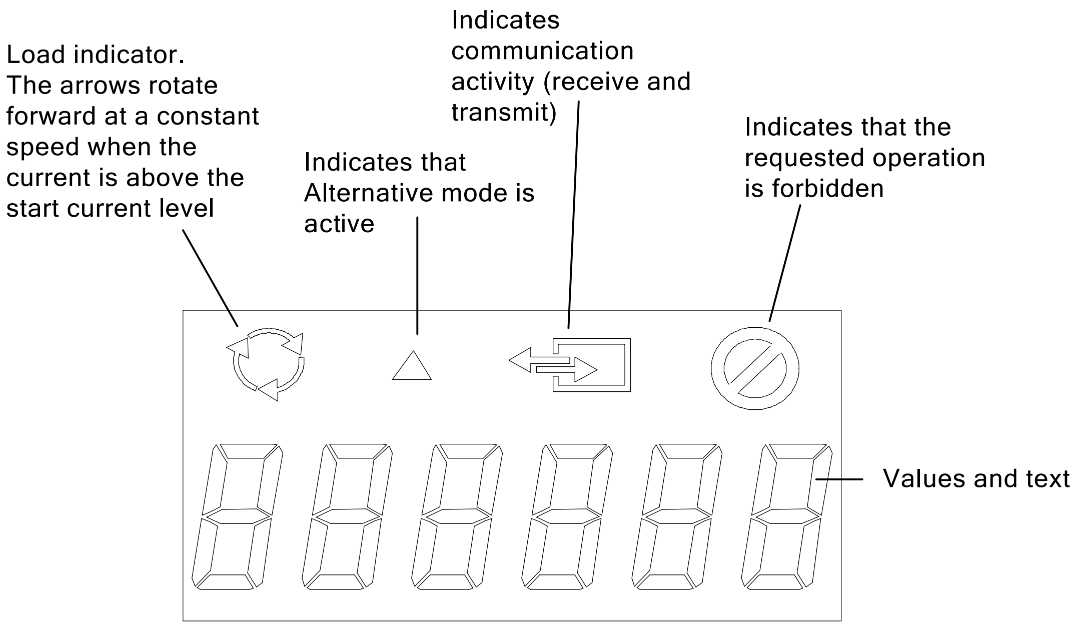


Fig. 2-5 ODINsingle meter LCD

2.6.2 7-SEGMENT CHARACTERS

All energy values are displayed by using the 6 characters unit segments. The figure below shows examples where the energy (21583 kWh) is displayed.

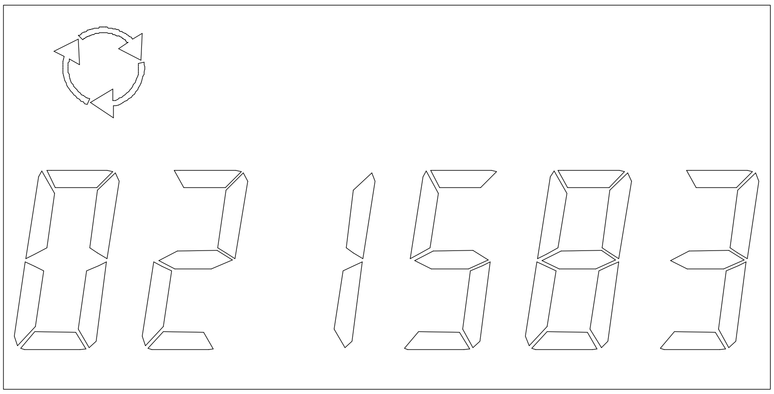


Fig. 2-6 Display of active energy

2.6.3 LOAD INDICATOR

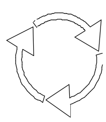


Fig. 2-7 Load indicator

There are three arrows, which will rotate as soon as the current is above the start current level. The rotating speed is constant and independent of the measured energy. If the metering is below the start current level all the arrows are constantly on and not rotating.

If the energy is positive the arrows are rotating in the forward direction and if the energy is negative the arrows are rotating backwards.

2.6.4 COMMUNICATION STATUS

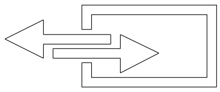


Fig. 2-8 Communication status

The M-bus communication status is indicated by the communication segments on the LCD which consists of two arrows going into and out of the meter (illustrated as a box). When the meter detects a valid message addressed to itself it sets the receive segment on (the arrow going into the box) and when it sends out a message it sets the transmit segment on (the arrow going out of the box).

2.6.5 FORBIDDEN OPERATION

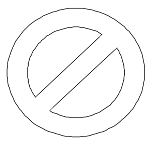


Fig. 2-9 Forbidden operation

If a forbidden operation is performed this is indicated by the deny symbol. Example of a forbidden operation is performing local reset on a meter where local reset is disabled.

2.7 DISPLAY MODES

The ODINsingle meter display system is dependant on the type of meter it is. In meters with possibility to reset the energy via a button two different display modes exist: Normal mode and Alternative mode. In all other meters only Normal mode exist. The two modes are distinguished from each other by the small triangle at the upper part of the LCD which is off in Normal mode and continuously on in Alternative mode. Some information is always displayed on the LCD, irrespective of active mode. At startup an LCD test is activated where all LCD segments is set on for a few seconds. Below in the figure is depicted the display system with its different modes and the different information displayed.

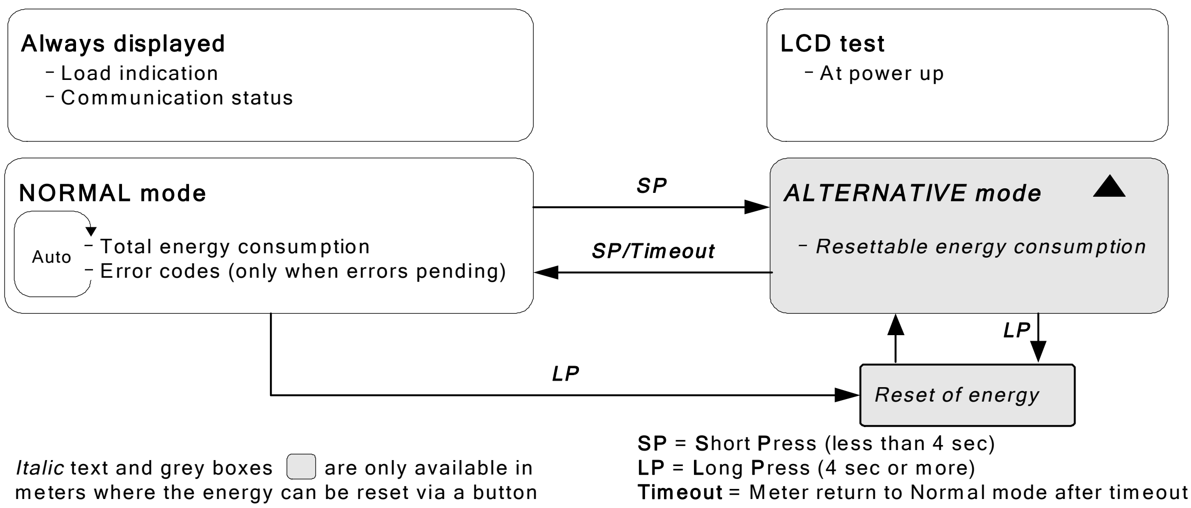


Fig. 2-10 Display system

2.7.1 LCD TEST AT POWER UP

At power up an LCD test is displayed (see figure below) for a few seconds and after that the normal mode is entered.

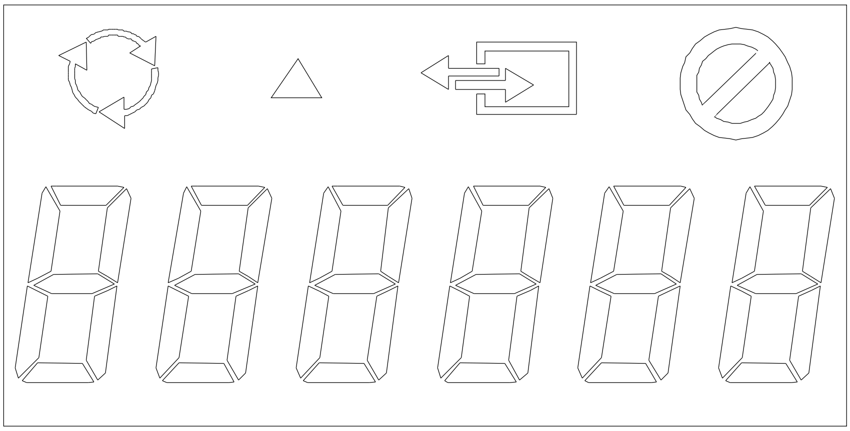


Fig. 2-12 LCD test

2.7.2 NORMAL MODE

Normal mode is the normal display condition where the energy is displayed in kWh with no decimals, see figure below.

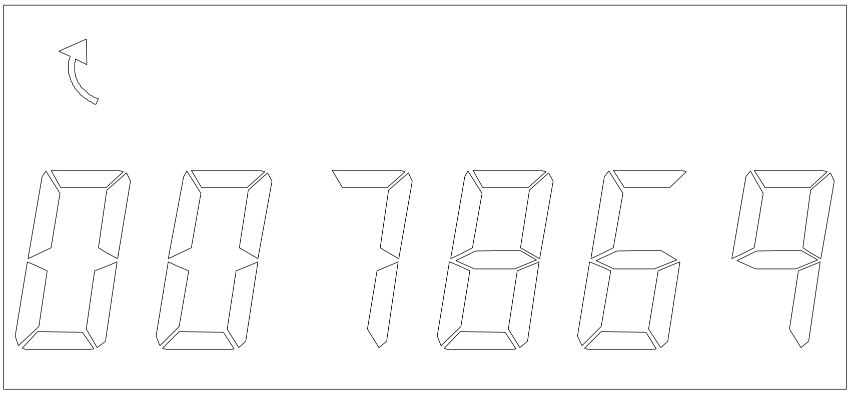


Fig. 2-11 Normal mode energy display

In meters with reset function the total energy (non-resettable) is displayed in Normal mode while the resettable energy is displayed in Alternative mode.

If errors are pending the energy and the error codes are displayed sequentially and automatically one at a time, see figure below where the error code 300 is displayed.

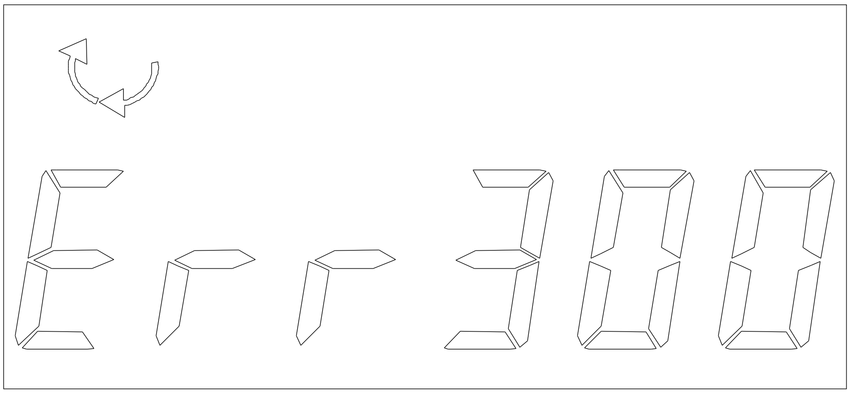


Fig. 2-12 Display of error codes

The energy is displayed for 6 seconds and each error code for 2 seconds. When the last error code has been displayed it will start all over again displaying the energy.

Normal mode will always be reached after a timeout time if the button is not pressed (normally for 10 seconds).

2.7.3 ALTERNATIVE MODE (WHEN APPLICABLE)

The Alternative mode is reached from Normal mode by pressing the button for less than 4 seconds (short scroll). The ODINsingle meter indicates being in Alternative mode by the triangle (△) being permanently lit.

In Alternative mode the resettable energy is displayed in kWh with no decimals, see figure below.

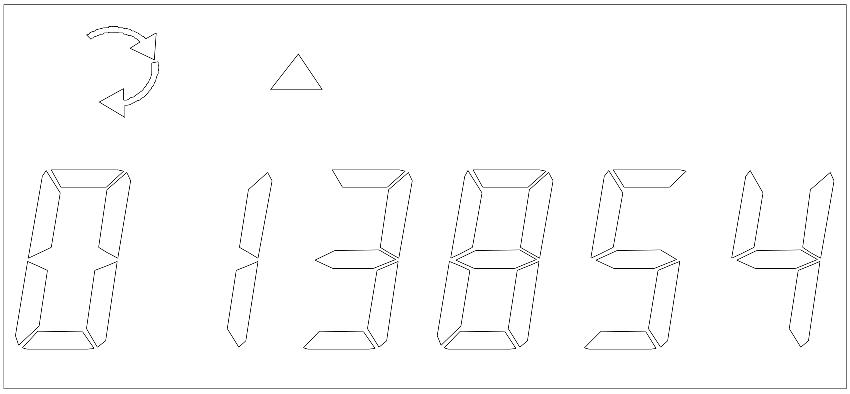


Fig. 2-11 Alternative mode energy display

In meters without reset function the Alternative mode is not used.

2.7.4 RESET OF ENERGY (OPTION)

In meters with reset function and button it is possible to reset the energy via the button (see position 4 in picture 2.1 in section 2.2).

The energy is reset by pressing the button for more than 4 seconds. When reset is done it is indicated on the LCD by a "moving zero" going from left to right. After reset the meter will always go to Alternative mode displaying the resettable energy (which will be all zeros).

2.8 PULSE OUTPUT (OPTION)

As an option the ODINsingle meter can be equipped with a pulse output for active energy. The pulse output sends out a certain amount of pulses per kilowatt hour.

The pulse output is galvanically isolated from the rest of the electronics in the meter. It fulfils the IEC standard 62053-31 and DIN 43 864 standard (often called S0). The output has a maximum voltage and current specified to 40 Volt DC and 100 mA. It is built with a transistor and an optocoupler of transistor type and is polarity dependent. The equivalent circuitry of the output is depicted below.

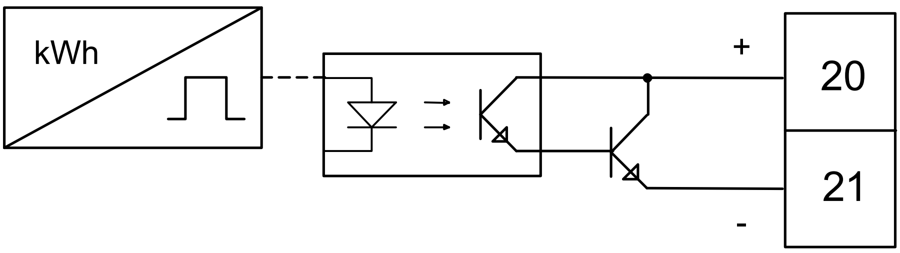


Fig. 2-14 Pulse output equivalent schematic diagram

2.9 ELECTRONICS

The energy measuring is realized electronically, see figure below where the electronics is depicted in a block diagram.

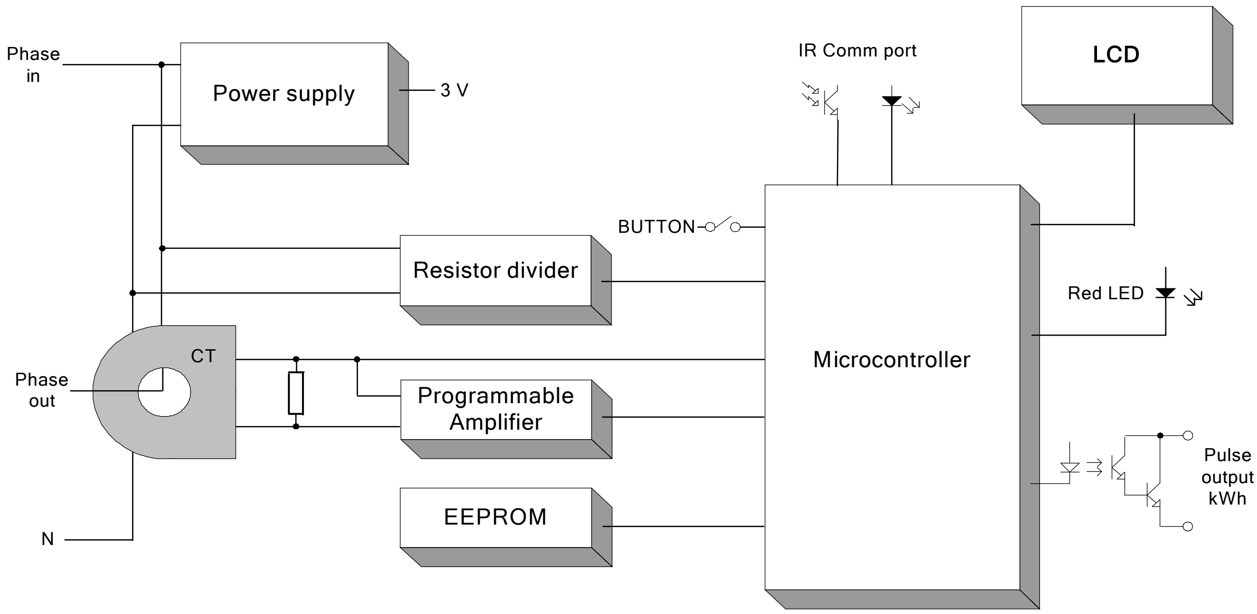


Fig. 2-15 Electronics block diagram

The meter hardware can be divided into the following parts:

- A microcontroller that performs the energy calculation. The voltage and current signals are sampled by A/D-converters incorporated in the microcontroller and multiplied together digitally to get the energy. The meter is calibrated via registers to fulfil the accuracy class requirements stated in the standards. The microcontroller also handles the LCD, EEPROM, red LED, programmable amplifier, infrared (IR) communication interface and the optional button and pulse output.
- An LCD (Liquid Crystal Display) for display of accumulated energy, status information etc.
- The current is measured with a current transformer (CT) through which the current to measure flows. The output current from the transformer flows through a load resistor which produces a voltage which is fed to the microcontroller. At low currents the signal is amplified with a programmable amplifier.
- The mains voltage is divided by a resistor divider and fed into the microcontroller.
- A push button (optional) to control the reset function and change display mode on the LCD.
- A power supply that generates a voltage that feeds the electronics (microcontroller, EEPROM etc).
- A red LED (Light Emitting Diode) that flashes with a certain energy pulse frequency (impulses/kWh).
- An optoisolated pulse output (optional) which give a certain amount of pulses per kWh.

- EEPROM for storing energy (1 total and 1 optional resettable register for active energy), calibration and initialization values for the microcontroller and for meter specific values which are used by the firmware in the microcontroller.
- An infra-red communication interface consisting of a phototransistor and a LED for connection to an external communication unit.

2.10 DIMENSIONS

Below the dimensions for the meter are displayed.

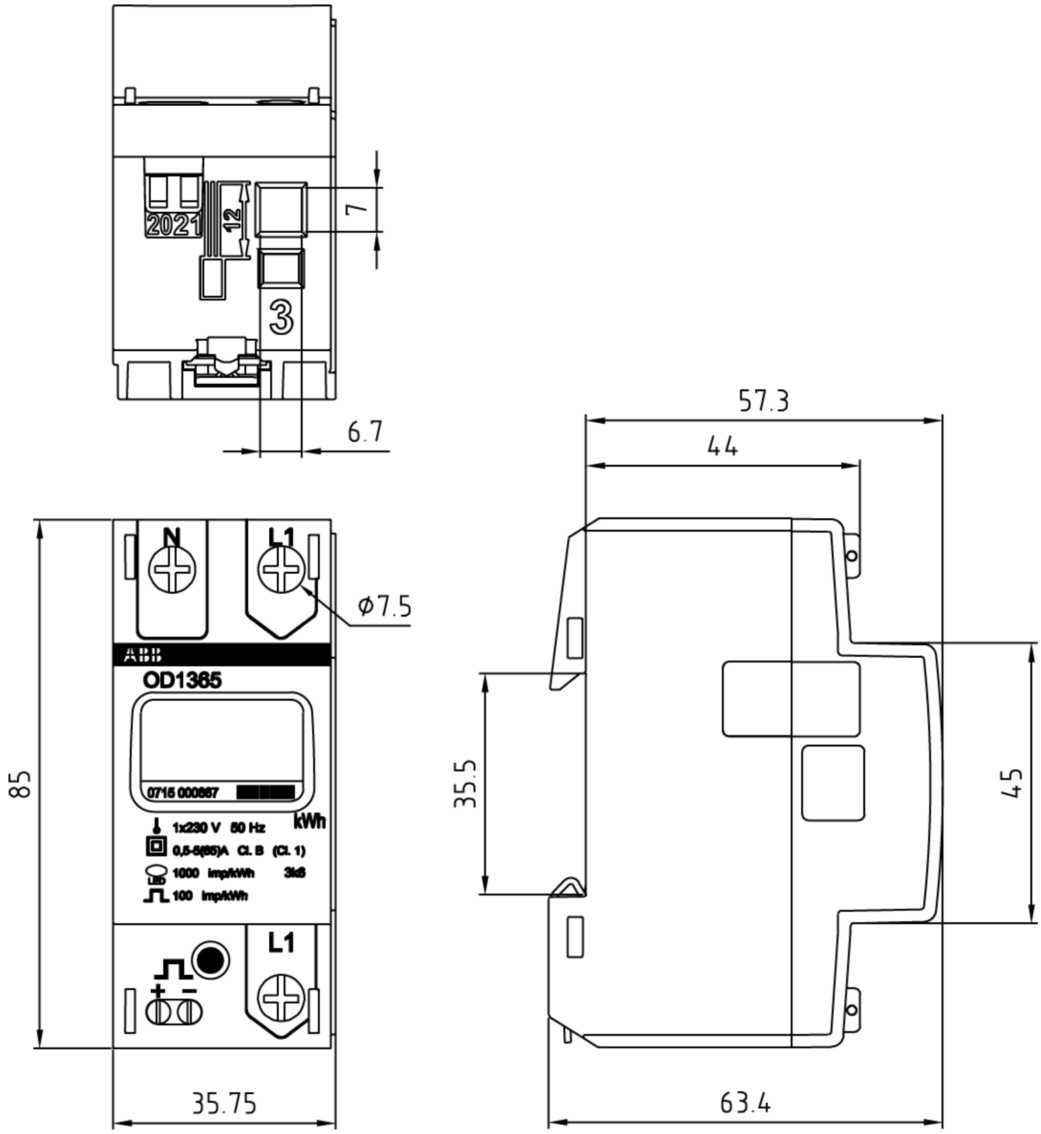


Fig. 2-16 Meter dimensions

3 TECHNICAL DATA

Direct connected, single phase meter, up to 65 A.

3.1 VOLTAGE

Nominal Voltage U_n:	1 x 220-240 VAC
Voltage range of U_n:	-20% to +15%

3.2 CURRENT

Min current I_{min}:	0.25 A
Min current inside class I_{tr}:	0.5 A
Reference alt. Base current I_{ref} (I_b):	5 A
Maximum current I_{max}:	65 A
Starting current I_{st}:	20 mA

3.3 GENERAL DATA

Frequency f_n:	50/60 Hz
Frequency range of f_n:	+/-5%
Accuracy Class:	B (Cl. 1)
Power consumption at 230 VAC and 5 A:	1.0 VA

3.4 STANDARDS

MID approval according to:	EN 50470-1, EN 50470-3
International approvals according to:	IEC 62052-11, IEC 62053-21

3.5 TEMPERATURE RANGE

Operating:	-25 to +55 ˚C
Storage:	-25 to +70 ˚C

3.6 ENCLOSURE MATERIAL

Top cover:	Polycarbonate
Bottom cover:	Polycarbonate/glass fibre
Glow wire test according to:	IEC 695-2-1

3.7 ENVIRONMENTAL CLASSES

Insulation protective class:	Class II
Mechanical environment:	M2
Electromagnetical environment:	E2
Resistance to heat and fire:	IEC 60695-2-10 to 11, Terminal (bottom cover) 960˚C, Cover 650˚C
Humidity:	75% yearly average, 95% on 30 days/year
Protection against penetration of dust and water:	IP20 on terminals, IP 51 when mounted in protective enclosure.

3.8 CONNECTION AREA MAIN TERMINALS

Current and main terminals:	Flexible or stranded 1 – 16 mm
Recommended tightening torque:	2 Nm

3.9 PULSE OUTPUT (OPTION)

Connection area:	Flexible, 0 - 2.5 mm², Solid 0 - 2.5mm²
Recommended tightening torque:	0.5 Nm
External pulse voltage:	5 – 40 V (DC), (Transistor output, polarity dependent)
Max. current:	100 mA
Pulse length:	100 (± 2,5) ms
Pulse frequency:	100 imp/kWh
Standard:	IEC 62053-31 (S0)

3.10 LED

Pulse frequency:	1000 imp/kWh
Pulse length:	40 ms

3.11 DISPLAY OF ENERGY

LCD with 6 digits, 6 mm high, without a decimal point

3.12 DIMENSIONS AND WEIGHT

Width 35.8 mm, 2 DIN modules
Height 85 mm.
Depth 63.4 mm.
Weight 0.145 kg

3.13 ELECTROMAGNETIC COMPABILITY

Impulse voltage test:	6 kV (IEC 60060-1, HD 588.1 S1)
Fast transient burst test:	4 kV (IEC 61000-4-4)
Immunity to electromagnetic HF-fields:	80 Mhz – 2 GHz (IEC 61000-4-3)
Immunity to conducted disturbance:	150 kHz – 80 MHz (IEC 61000-4-6)
Radio frequency emission:	EN 55022, class B (CISPR22)
Electrostatic discharge (ESD)	15 kV (IEC 61000-4-2)

4 INSTALLATION

WARNING! The voltages connected to the ODINsingle are dangerous and can be lethal. Therefore all voltages must be switched off when installing the ODINsingle. Do not operate the ODINsingle-meter outside the specified technical data. Installation and commissioning may only be carried out by authorised electrical specialists. The installer is responsible that the electricity meter is correctly and safely installed.

To comply with the protection requirements the meter must be mounted in a class IP51 enclosure or better, according to IEC 60529.

4.1 MOUNTING

The ODINsingle can be mounted in different ways. Below is described the most common ways.

For some of the mounting alternatives additional accessories are needed (for part numbers see chapter 7).

4.1.1 DIN-RAIL MOUNTED

The ODINsingle is aimed to be mounted on a DIN-rail designed according to the standard CEI/IEC 715. In this case no extra accessories are needed and the meter is fastened on the rail so that the metal snap piece on the back of the meter snaps onto the rail.

4.2 WIRING DIAGRAMS

Below is described how to connect the meters to the electricity network. The ODINsingle must always be protected by a fuse on the incoming side.

4.2.1 VOLTAGE AND CURRENT

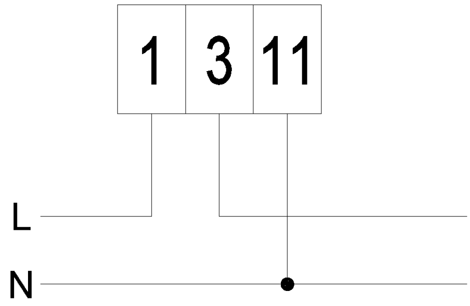


Fig. 4-2 Wiring diagram

4.2.2 PULSE OUTPUT (OPTION)

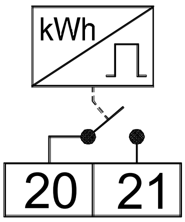


Fig. 4-3 Pulse output connection diagram

5 MEASUREMENT METHOD

The ODINsingle is a direct connected single phase meter measuring the active energy consumption in a 2-wire installation, see figure below.

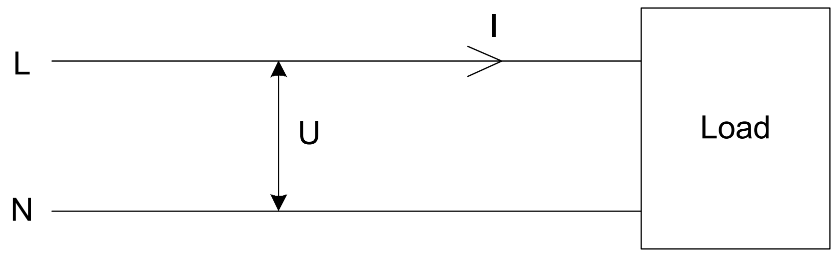


Fig. 5-1 Single phase measurement.

The metering calculation in the meter is done digitally by a microcontroller according to the formula:

$$E = \sum_{n=0,1,2...} k \bullet u(n \bullet T) \bullet i(n \bullet T)$$

k is a calibration constant, u the voltage and i the current. The voltage and current signals are sampled regularly (once every time interval T) by an analog-to-digital converter and via software multiplied together to give an amount of energy. This energy is accumulated to an energy register E which keeps track of the total energy. In meters with resettable energy two registers are used, one for the total energy and one for the resettable energy.

6 COMMUNICATION

Reading a meter through a communication interface gives a number of advantages compared to manual reading:

- The time it takes to read a number of meters is much shorter. It is also possible to perform continuous readings.
- The risk of getting wrong values because of mistakes during manual reading is reduced to a minimum.
- The values are stored electronically, which makes it easier to process them further.

All ODINsingle have an optical interface on the left side of the meter. For communication via the optical interface the M-Bus protocol is used.

This chapter describes the M-Bus communication.

6.1 M-BUS

The M-Bus (Meter Bus) is a bus system for the remote reading of meters. It is a master-slave system for communication on twisted pair where all meters are slaves.

6.1.1 COMMUNICATION OBJECTS

Communication objects in the ODINsingle meter are listed in table below.

Register	Description
Total active energy	Cumulative total active energy. Only possible to read.
Resettable active energy	Cumulative resettable active energy (coded as tariff 1 active energy). Possible to read and reset.
Power fail counter	Counter that increment one step each time there meter is switched off. Possible to read and reset.
Reset counter	Counter that increments one step each time the resettable energy is reset. Only possible to read.
Manufacturing information	Manufacturer code, serial number etc located in telegram header.
Firmware version	Firmware version of program code in the meter. Only possible to read.
Error/information flags	Error and information flags. Possible to read, some possible to clear.

6.1.2 PHYSICAL INTERFACE

The physical interface uses serial half-duplex asynchronous communication. Since the bus has a master-slave structure, where there must and can be only one master, the meters cannot communicate with each other.

6.1.2.1 Optical interface

The ODINsingle has an optical interface located on the left side. Physical characteristics of the interface correspond to the standard IEC 61107. Communication speed is 2400 bps.

6.1.3 PROTOCOL DESCRIPTION

The M-Bus protocol is based on the international standard IEC 61870, but it does not use all of its specified functions.

When there is no communication on the bus it is in Mark-state.

Each communicated byte consists of eleven bits. The bits are one start-bit (space), eight data bits, one parity bit (even) and one stop bit (mark). The least significant bit is transmitted first.

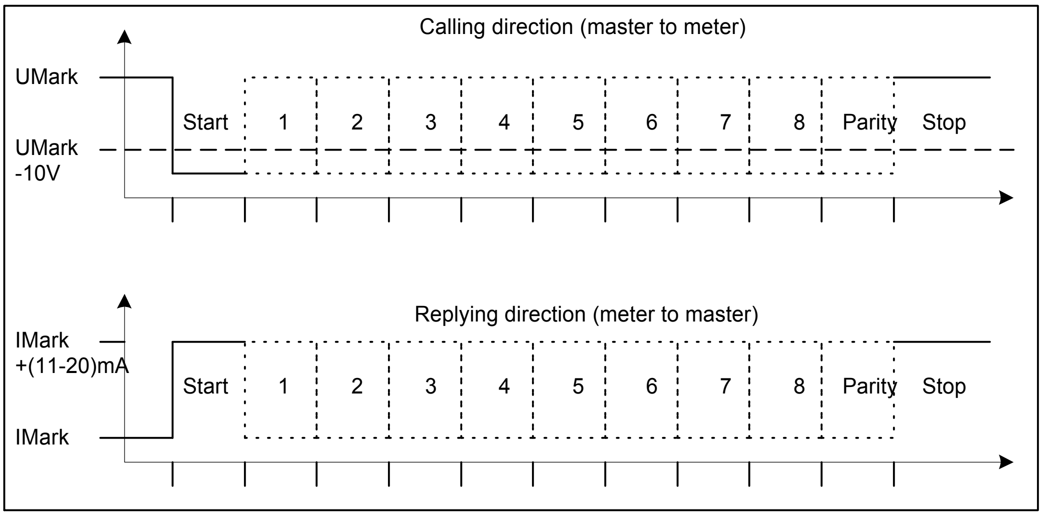


Fig. 6-1 Transmission of a Character in Calling and Replying Direction

6.1.3.1 Telegram formats

The telegram formats are structured according to format class FT1.2. The FT1.2 format fulfils the data integrity class I2, including a hamming distance of four. Three telegram formats are used. The start character identifies the different telegram formats.

Single Character	Short Frame	Long Frame
E5h	Start (10h)	Start (68h)
	C-field	L-field
	A-field	L-field
	Check Sum	Start (68h)
	Stop (16h)	C-field
		A-field
		CI-field
		User Data (0-252 byte)
		Check Sum
		Stop (16h)

Telegram Formats

- **Single character** - The Single character format consists of a single character (E5h) and is used to acknowledge received telegrams.
- **Short frame** - The Short frame format is identified by its start character (10h) and consists of five characters. Besides the C- and A-fields it includes the checksum and the stop character 16h.
- **Long frame** - The Long frame format is identified by its start character (68h) and consists of a variable number of characters. After the start character the L-field is transmitted twice, then the start character once again followed by the C-, A- and CI-fields. The user data (0 - 252 bytes) is transmitted after the CI-field followed by the check sum and the stop character (16h).

6.1.3.1.1 Field descriptions

All fields used in the telegram frames have a length of one byte (8 bits).

- Length field (L-field)
The L-field gives the quantity of the user data inputs plus 3 (for the C-, A- and CI-fields). It is transmitted twice in telegrams using the long frame format.

- Control field (C-field)
The C-field contains information of the direction of the data flow, error handling and besides labelling the functions and the actions caused by them, the control field specifies the direction of data flow, and is responsible for various additional tasks in both the calling and replying directions.

Bit number	7	6	5	4	3	2	1	0
To the meter	0	PRM	FCB	FCV	F3	F2	F1	F0
From the meter	0	PRM	0	0	F3	F2	F1	F0

Coding of the Control Field

- The primary message bit (PRM) is used to specify the direction of data flow. It is set to 1 when a telegram is sent from a master to the meter and to 0 in the other direction.
- The frame count bit valid (FCV) is set to 1 by the master to indicate that the frame count bit (FCB) is used. When the FCV is set to 0, the meter ignores the FCB.
- The FCB is used to indicate successful transmission procedures. A master shall toggle the bit after a successful reception of a reply from the meter. If the expected reply is missing, or the reception of it is faulty, the master resends the same telegram with the same FCB. The meter answers, to a REQ_UD2-request with toggled FCB and a set FCV, with a RSP_UD containing the next telegram of a multi-telegram answer. If the FCB is not toggled it will repeat the last telegram. The actual values will be updated in a repeated telegram. On receipt of a SND_NKE the meter clears the FCB. The meter uses the same FCB for primary addressing, secondary addressing and point-to-point communication.
- The bits 0 to 3 (F0, F1, F2 and F3) of the control field are the function code of the message.

Name	C-field (binary)	C-field (hex)	Telegram	Description
SND_NKE	0100 0000	40	Short Frame	Initialization of Meter
SND_UD	01F1 0011	53/73	Long Frame	Send User Data to Meter
REQ_UD2	01F1 1011	5B/7B	Short Frame	Request for Class 2 Data
RSP_UD	0000 1000	08	Long Frame	Data Transfer from Meter to Master after Request

Function Codes

- Address Field (A-field)
The address field is used to address the recipient in the calling direction, and to identify the sender of information in the receiving direction. The size of this field is one byte, and can therefore take values from 0 to 255.

- The address 0 is given to meters at manufacturing.
- The addresses 1 to 250 are given to the meters as individual primary addresses. The address can be set via the bus (see chapter 6.1.4.3.2).
- The addresses 251 and 252 are reserved for future use.
- The address 253 (FDh) is used by the secondary addressing procedure.
- The address 254 (FEh) is used for point-to-point communication. The meter replies with its primary address.
- The address 255 (FFh) is used for broadcast transmissions to all meters. None of the meters replies to a broadcast message.

- Control Information Field (CI-field)
The CI-field codes the type and sequence of application data to be transmitted in the frame. Bit two (counting begins with bit 0, value 4), called M-bit or Mode bit, in the CI-field gives information about the used byte sequence in multi-byte data structures. For communication with the ODINsingle meter, the Mode bit shall not be set (Mode 1) meaning the least significant byte of a multi-byte record is transmitted first.

CI	Application
51h	Data send
52h	Selection of slaves

CI-field codes to use by the master

The meter uses code 72h in the CI-field for responses to requests for user data.

-User Data
The User Data contains the data to be sent to the recipient.

Fixed Data Header	Data Records	MDH
12 Byte	Variable number of bytes	1 Byte

Structure of the User Data meter to master

Data Records
variable number of bytes

Structure of the User Data master to meter

Fixed Data Header

Identification No	Manufacturer	Version	Medium	Access No	Status	Signature
4 Byte	2 Byte	1 Byte	1 Byte	1 Byte	1 Byte	2 Byte

Structure of the Fixed Data Header

- **Identification Number** is the 8-digit serial number of the meter (BCD coded).
- **Manufacturer** is set to 0442h meaning ABB.
- **Version** specifies the version of the protocol implementation.
- **Medium** byte is set to 02h to indicate electricity.
- **Access Number** is a counter that counts successful accesses.
- **Status** byte is used to indicate the meter status.

Bit	Meaning
0	Meter busy
1	Internal error
2	Power low
3	Permanent error
4	Temporary error
5	Installation error [1)]
6	NOT USED
7	NOT USED

[1)] Manufacturer specific

- **Signature** is set to 00 00h.

Data Records
The data, together with information regarding coding, length and the type of data is transmitted in data records. The maximum total length of the data records is 234 bytes.

Data Record Header (DRH)				Data
Data Information Block (DIB)		Value Information Block (VIB)		
DIF	DIFE	VIF	VIFE	
1 Byte	0-10 Bytes	1 Byte	0-10 Bytes	0-n Bytes

Structure of a Data Record (transmitted from left to right)

Each data record consists of a data record header (DRH) and the actual data. The DRH in turn consists of the data information block (DIB) to describe the length, type and coding of the data, and the value information block (VIB) to give the value of the unit and the multiplier.

Data Information Block (DIB)
The DIB contains at least one byte (Data Information Field, DIF), and is in some cases expanded with, a maximum of 10, DIFE's (Data Information Field Extension).

Bit 7	6	5	4	3	2	1	0
Extension Bit	LSB of storage number	Function Field		Data Field : Length and coding of data			

Structure of the Data Information Field (DIF)

- The **Extension Bit** is set when next byte is a DIFE.
- The **LSB of storage number** is normally set to 0 to indicate actual value (1 = stored value).
- The **Function Field** is always set to 00 indicating instantaneous value.
- The **Data Field** shows the format of the data.

Code	Meaning	Length in Byte
0000	No data	0
0001	8 Bit Integer	1
0010	16 Bit Integer	2
0100	32 Bit Integer	4
0111	64 Bit Integer	8
1010	4 digit BCD	2
1011	6 digit BCD	3
1100	8 digit BCD	4
1101	Variable length (ASCII)	Variable
1110	12 digit BCD	6

Coding of the Data Field

Bit 7	6	5	4	3	2	1	0
Extension Bit	Unit	Tariff		Storage Number			

Structure of the Data Information Field Extension (DIFE)

- The **Extension Bit** is set when next byte is a DIFE.
- **Unit** is used on power and energy values to tell what type of power/energy the data is. Always set to 0 in ODINsingle.
- **Tariff** is used on energy values to give tariff information (0 = Total, 1 = Tariff 1). 0 is used for the total (non-resettable) energy and 1 is used for the resettable) energy.
- **Storage Number** is used to indicate an instantaneous or stored (historical) value (>0 = stored value). Always set to 0 in ODINsingle.

Value Information Block (VIB)

The VIB follows a DIF or DIFE without a set extension bit. It contains one Value Information Field (VIF) and is in some cases expanded with up to 10, Value Information Field Extensions (VIFE).

Bit 7	6	5	4	3	2	1	0
Extension Bit	Value Information						

Structure of the Value Information Field (VIF)

Value Information contains information about the value (unit, status etc).
The Extension Bit is set when next byte is a VIFE.

In case VIF or VIFE = FFh the next VIFE is manufacturer specific. The manufacturer specific VIFE has the same construction as a VIF. If the extension bit of the manufacturer specific VIFE is set, and the VIFE is less than 1111 1000, the next byte is a standard VIFE, otherwise it is the first data byte. If the extension bit of the manufacturer specific VIFE is set and the VIFE is bigger or equal to 1111 1000, the next byte is an extension of manufacturer specific VIFE's.

VIF-Code	Description	Range Coding	Range
E000 0nnn	Energy	$10^{(nnn-3)}$ Wh	0.001Wh to 10000Wh
E111 1010	Bus Address		0 to 250
1111 1011	Extension of VIF-codes		Not used by ODINsingle
1111 1101	Extension of VIF-codes		True VIF is given in the first VIFE and is coded using Table FD
1111 1111	Manufacturer Specific		Next VIFE is manufacturer specific

Codes for Value Information Field (VIF)

Codes for Value Information Field Extension (VIFE) used with extension indicator FDh
If the VIF contains the extension indicator FDh the true VIF is contained in the first VIFE.

VIFE-Code	Description
E000 1110	Firmware Version
E001 0111	Error and Information Flags (binary)

Table FD

Codes for Value Information Field Extension (VIFE)
The following values for VIFE's are defined for an enhancement of VIF's other than FDh and FBh:

VIFE-Code	Description
1111 1111	Next VIFE is manufacturer specific

Manufacturer specific VIFE-Codes

VIFE-Code	Description
E001 1000	Power fail counter
E111 0001	Reset counter
E111 1001	Extension of manufacturer specific VIFE's, next VIFE(s) specifies actual meaning

2:nd manufacturer specific VIFE followed after VIFE 1111 1001 (F9 hex)

VIFE-Code	Description
E000 1000	Button reset rights

VIFE-Codes for reports of record errors (meter to master)

VIFE-Code	Type of Record Error	Error Group
E000 0000	None	
E001 0101	No data available (undefined value)	
E001 1000	Data error	Data Errors

VIFE-Codes for object actions (master to meter)

VIFE-Code	Action	Description
E000 0111	Clear	Set data to zero
E000 1101	Disable	Delete from readout

Data
The Data follows a VIF or a VIFE without the extension bit set.

Manufacturer Data Header (MDH)
The manufacturer data header (MDH) is made up by the character (0Fh or 1Fh). 1Fh indicates that more data will follow in the next telegram. 0Fh indicates that all data has been read.

Manufacturer specific data
Manufacturer specific data is sent immediately after the MDH. The commands are sent using SND_UD. The syntax for the commands is [VIF (2 bytes)][data (0-196 bytes)].

-Check Sum
The Check Sum is used to recognize transmission and synchronization faults. It is calculated from the arithmetical sum of the bytes from the control field to the last user data, without taking carry digits into account.

6.1.3.2 Communication process

The Data Link Layer uses two kinds of transmission services:

Send / Confirm	SND / CON
Request / Respond	REQ / RSP

After the reception of a correct telegram the meter waits maximum 180ms before answering. A received telegram is considered as correct if it passes the following tests:

- Start /Parity /Stop bits per character
- Start /Check Sum /Stop characters per telegram format
- The second Start character, the parity of the two field lengths, and the number of additional characters received (= L Field + 6) with a long frame

Send / Confirm Procedure
SND_NKE
This procedure serves to start up after the interruption or beginning of communication. If the meter was selected for secondary addressing, it will be deselected. The value of the frame count bit FCB is cleared in the meter, i.e. it expects that the first telegram from a master with FCV=1 contains a FCB=1. The meter either confirms a correct reception with the single character acknowledge (E5h) or omits the confirmation if it did not receive the telegram correctly.

SND_UD
This procedure is used to send user data to the meter. The meter either confirms a correct reception with the single character acknowledge (E5h) or omits the confirmation if it did not receive the telegram correctly.

Request / Respond Procedure
REQ_UD2 / RSP_UD
The master requests data from the meter using the REQ_UD2 telegram. The meter will either transfer its data with RSP_UD, or gives no response indicating that the request has not been received correctly or that the address does not match. The meter indicates to the master that there is more data in the next telegram by sending 1Fh as the last user data.

6.1.3.2.1 Selection and Secondary Addressing

It is possible to communicate with the meter using secondary addressing. The secondary addressing takes place with help of a selection:

68h	0Bh	0Bh	68h	53h	FDh	52h	ID1-4	Man 1-2	Gen	Med	CS	16h

Structure of a telegram for selecting a meter

The master sends a SND_UD with the control information 52h to the address 253 (FDh) and fills the specific meter secondary address (identification number, manufacturer, version and medium) with the values of the meter that is to be addressed. The address FDh and the control information 52h is the indication for the meter to compare the following secondary address with its own and to change into the selected state should it match. In this case the meter answers the selection with an acknowledgement (E5h), otherwise it does not reply. Selected state means that the meter can be addressed with the bus address 253 (FDh).

During selection individual positions of the secondary addresses can be occupied with wildcards. Such a wildcard means that this position will not be taken into account during selection. In the identification number each individual digit can be set as a wildcard by a wildcard nibble Fh while the fields for manufacturer, version and medium can be set as a wildcard by a wildcard byte FFh.

The meter will remain selected until it receives a selection command with non-matching secondary addresses, a selection command with CI=56h, or a SND_NKE to address 253.

6.1.4 TELEGRAMS

The communication can be divided in two parts. One part is reading data from the meter and the other part is sending data to it. This section describes typical telegrams sent to and received from the ODINsingle.

The data readout procedure starts when the master sends a REQ_UD2 telegram to the meter. The meter responds with a RSP_UD telegram. The last DIF in the user data part of the telegram is 0F to indicate that there are no more telegrams to read.

Using SND_UD telegrams data or commands can be sent to the meter. The following is possible to perform with SND_UD telegrams on the ODINsingle meter:

- Reset of energy (only possible in resettable meters)
- Set primary address
- Clear error flags
- Disable error flags
- Reset power fail counter
- Enable / disable local reset (only possible in resettable meters)

6.1.4.1 Minimum time between requests

It may not be possible to read data from the meter too frequently. When the meter sends out data it uses power stored in a capacitor. If the voltage of the capacitor drops below a certain level the meter will stop sending out the telegram. If this happens it is recommended to make a small delay (approximately 1 second) to allow for the internal capacitor to be charged. Recommended minimum time between a received telegram and the next request is 100ms.

6.1.4.2 Read out telegram

Below is specified the telegram sent out by the ODINsingle meter at a normal read out, that is after the ODINsingle meter have received a request user data 2 command (REQ_UD2) *)

<table>
<tr><th>Byte No</th><th>Size (in bytes)</th><th>Value</th><th>Description</th><th>Explanation</th></tr>
<tr><td>1</td><td>1</td><td>68</td><td>Start character</td><td>[always same]</td></tr>
<tr><td>2</td><td>1</td><td>49</td><td>L-field, calculated from C field to last user data</td><td>0x49 = 73 bytes (byte no 5 to 77)</td></tr>
<tr><td>3</td><td>1</td><td>49</td><td>L-field, repeated</td><td>[same as above]</td></tr>
<tr><td>4</td><td>1</td><td>68</td><td>Start character</td><td>[always same]</td></tr>
<tr><td>5</td><td>1</td><td>08</td><td>C-field, RSP_UD</td><td>0000 1000
| | | | ++++- Function, 8 = User data
| | | +-------- DFC, 0 = can accept further data
| | +--------- ACD, 0 = class 2 data
| +----------- Direction, 0 = from meter
+------------- [always 0]</td></tr>
<tr><td>6</td><td>1</td><td>xx</td><td>A-field, address</td><td>Primary address 1-250, 0 = No primary address</td></tr>
<tr><td>7</td><td>1</td><td>72</td><td>CI-field, variable data respond, LSB first</td><td>0111 0010
++++ +|++- Variable data respond
+---- Mode 1 = LSB first</td></tr>
<tr><td>8-11</td><td>4</td><td>xxxxxxxx</td><td>Identification Number, 8 BCD digits</td><td>Serial number. LSB first, 12 34 56 78 sent as 78 56 34 12</td></tr>
<tr><td>12-13</td><td>2</td><td>4204</td><td>Manufacturer: ABB</td><td>ABB = 0442, LSB first gives 4204</td></tr>
<tr><td>14</td><td>1</td><td>11</td><td>Version</td><td>Protocol version, decided by ABB</td></tr>
<tr><td>15</td><td>1</td><td>02</td><td>Medium, 02 = Electricity</td><td>02 = electricity</td></tr>
<tr><td>16</td><td>1</td><td>xx</td><td>Number of accesses</td><td>Increased by 1 after every respond (RSP_UD)</td></tr>
<tr><td>17</td><td>1</td><td>xx</td><td>Status</td><td>00xx xxxx
| | | | | | | +- Application busy
| | | | | | +-- Any application error (application = internal)
| | | | | +---- Power low
| | | | +----- Permanent error
| | | +-------- Temporary error
| | +--------- Installation error (specific to manufacturer)
| +----------- Not used (specific to manufacturer)
+------------- Not used (specific to manufacturer)</td></tr>
<tr><td>18-19</td><td>2</td><td>0000</td><td>Signature (0000 = no encryption)</td><td>[always same]</td></tr>
<tr><td>20</td><td>1</td><td>0E</td><td>DIF size, 12 digit BCD</td><td>0000 1110
| | | | ++++- 12 digit BCD
| | ++-------- Instantaneous value
| +----------- LSB of storage number
+------------- No DIFE follows</td></tr>
<tr><td>21</td><td>1</td><td>84</td><td>VIF for units kWh with resolution 0,01kWh 2dec</td><td>1000 0100
| | | | |+++- 0b100 = 4, 10^(4-3) = 10 = 0.01k
|+++ +----- Unit is Wh
+------------- VIFE will follow</td></tr>
<tr><td>22</td><td>1</td><td>xx</td><td>VIFE, status</td><td>0xxx xxxx
|+++ ++++- Status code
+------------- No VIFE follows</td></tr>
<tr><td>23-28</td><td>6</td><td>xxxxxxxx xxxx</td><td>Active energy, Total</td><td>kWh with two decimals and LSB first</td></tr>
<tr><td>29</td><td>1</td><td>8E</td><td>DIF size, 12 digit BCD</td><td>1000 1110
| | | | ++++- 12 digit BCD
| | ++-------- Instantaneous value
| +----------- LSB of storage number
+------------- DIFE will follow</td></tr>
<tr><td>30</td><td>1</td><td>10</td><td>Tariff 1</td><td>0001 0000
| | | | ++++- Storage number, continued
| | ++-------- Tariff 1
| +----------- Same device, no sub unit
+------------- No DIFE follows</td></tr>
<tr><td>31</td><td>1</td><td>84</td><td>VIF for units kWh with resolution 0,01kWh 2dec</td><td>1000 0100
| | | | |+++- 0b100 = 4, 10^(4-3) = 10 = 0.01k
|+++ +----- Unit is Wh
+------------- VIFE will follow</td></tr>
<tr><td>32</td><td>1</td><td>xx</td><td>VIFE, status</td><td>0xxx xxxx
|+++ ++++- Status code
+------------- No VIFE follows</td></tr>
<tr><td>33-38</td><td>6</td><td>xxxxxxxx xxxx</td><td>Active energy, Tariff 1 (resettable enrgy)</td><td>kWh with two decimals and LSB first</td></tr>
</table>

Telegram continues on next page.

*) Notice that the telegram structure may differ in different protocol versions. Any remote reading system should decode the telegram according to M-Bus standard, not according to the specific telegram stated here.

Telegram continued (all values are hexadecimal).

Byte No	Size (in bytes)	Value	Description	Explanation
39	1	07	DIF size, 64 bit integer	0000 0111 |||| ++++- 64 bit integer || ++-------- Instantaneous value | +----------- LSB of storage number +------------- No DIFE follows
40-41	2	FD97	Error codes	1111 1011 ++++ ++++- True VIF according to table $FD follows in VIFE 1001 0111 |+++ ++++- Error flags, binary +------------- VIFE will follow
42	1	xx	VIFE, status	0xxx xxxx |+++ ++++- Error code +------------- No VIFE follows
43-50	8	xxxxxxxx xxxxxxxx	Error flags, represented binary	Error flags, as defined by ABB
51	1	01	DIF size, 8 bit integer	0000 0001 |||| ++++- 8 bit integer || ++-------- Instantaneous value | +----------- LSB of storage number +------------- No DIFE follows
52-53	2	FF98	Power fail counter	1111 1111 |+++ ++++- VIFE and data is manufacturer specific +------------- VIFE will follow 1001 1000 |+++ ++++- Power fail counter (decided by ABB) +------------- VIFE will follow
54	1	xx	VIFE, status	0xxx xxxx |+++ ++++- Error code +------------- No VIFE follows
55	1	xx	Power fail counter	Number of power fails
56	1	04	DIF size, 32 bit integer	0000 0100 |||| ++++- 32 bit integer || ++-------- Instantaneous value | +----------- LSB of storage number +------------- No DIFE follows
57-58	2	FFF1	Reset counter	1111 1111 |+++ ++++- VIFE and data is manufacturer specific +------------- VIFE will follow 1111 1000 |+++ ++++- Reset counter (decided by ABB) +------------- VIFE will follow
59	1	xx	VIFE, status	0xxx xxxx |+++ ++++- Error code +------------- No VIFE follows
60-63	1	xxxxxxxx	Reset counter	Number of resets
64	1	0D	DIF size, variable length	0000 1101 |||| ++++- Variable length || ++-------- Instantaneous value | +----------- LSB of storage number +------------- No DIFE follows
65-66	2	FD8E	Firmware version	1111 1011 ++++ ++++- True VIF according to table $FD follows in VIFE 1000 1110 |+++ ++++- Firmware version +------------- VIFE will follow
67	1	xx	VIFE, status	0xxx xxxx |+++ ++++- Error code +------------- No VIFE follows
68	1	08	ASCII string, 8 characters	0000 1000 ++++ ++++- ASCII string, 8 characters
69-76	8	xxxxxxxx xxxxxxxx	Firmware version	Firmware version in ASCII format with LSB first in format "Mxxx-yyy" where xxx specifies the total firmware version and yyy the version of the basic metering part of the firmware
77	1	0F	DIF indicating that this is the last telegram	0000 1111 |||| ++++- Special function ||| +-------- 0 = End of telegram +++--------- [always same]
78	1	xx	CS checksum, calculated from C field to last data	Checksum on byte number 5 to 69
79	1	16	Stop character	[always same]

6.1.4.3 Sending data to the meter

Below are described telegrams possible to send to the ODINsingle meter. Some telegrams contain data and some not. Data sent in the telegram are sometimes stored in the meter, sometimes used by the meter when performing a certain action. Telegrams containing no data usually initiate a certain action in the meter.

6.1.4.3.1 Reset of energy

In meters with possibility to reset the energy the energy is reset (set to 0) by the following command (all values are hexadecimal):

<table>
<tr><th>Byte No</th><th>Size (in bytes)</th><th>Value</th><th>Description</th><th>Explanation</th></tr>
<tr><td>1</td><td>1</td><td>68</td><td>Start character</td><td>[always same]</td></tr>
<tr><td>2</td><td>1</td><td>07</td><td>L-field, calculated from C field to last user data</td><td>No of bytes between byte no 5 and byte no 10</td></tr>
<tr><td>3</td><td>1</td><td>07</td><td>L-field, repeated</td><td>[same as above]</td></tr>
<tr><td>4</td><td>1</td><td>68</td><td>Start character</td><td>[always same]</td></tr>
<tr><td>5</td><td>1</td><td>53/73</td><td>C-field, SND_UD</td><td>01x1 0011
| | | | ++++- Function, 3 = Send user data
| | | +------- FCV, 1 = FCB is valid
| | +--------- FCB, Alternate for successive transfers
| +----------- Direction, 1 = to meter
+------------- [always 0]</td></tr>
<tr><td>6</td><td>1</td><td>xx</td><td>A-field, address</td><td>Primary address 1-250, 0 = No primary address</td></tr>
<tr><td>7</td><td>1</td><td>51</td><td>CI-field, data send, LSB first</td><td>0101 0001
++++ +|++- Data send
+---- Mode, 0 = Mode 1 (LSB first)</td></tr>
<tr><td>8</td><td>1</td><td>80</td><td>DIF size, no data</td><td>1000 0000
| | | | ++++- No data
| | ++-------- Instantaneous value
| +----------- LSB of storage number
+------------- DIFE follows</td></tr>
<tr><td>9</td><td>1</td><td>10</td><td>DIFE</td><td>0001 0000
| | | | ++++ Storage number
| | ++------- Tariff
| +----------- Unit
+------------- No VIFE follows</td></tr>
<tr><td>10</td><td>1</td><td>84</td><td>VIF for units kWh with resolution 0,01kWh 2dec</td><td>0000 0100
| | | | |+++- 0b100 = 4, 10^(4-3) = 10 = 0.01k
|+++ +----- Unit is Wh
+------------- No VIFE</td></tr>
<tr><td>11</td><td>1</td><td>07</td><td>Clear</td><td>0000 0111
|+++ ++++- Clear data
+------------- No VIFE follows</td></tr>
<tr><td>12</td><td>1</td><td>xx</td><td>CS checksum, calculated from C field to last data</td><td>Checksum on bytes between byte no 5 and byte no 10</td></tr>
<tr><td>13</td><td>1</td><td>16</td><td>Stop character</td><td>[always same]</td></tr>
</table>

6.1.4.3.2 Set primary address

The primary address is set by sending the following command (all values are hexadecimal):

Byte No	Size (in bytes)	Value	Description	Explanation
1	1	68	Start character	[always same]
2	1	06	L-field, calculated from C field to last user data	No of bytes between byte no 5 and byte no 10
3	1	06	L-field, repeated	[same as above]
4	1	68	Start character	[always same]
5	1	53/73	C-field, SND_UD	01x1 0011 | | | | ++++- Function, 3 = Send user data | | | +------- FCV, 1 = FCB is valid | | +--------- FCB, Alternate for successive transfers | +----------- Direction, 1 = to meter +------------- [always 0]
6	1	xx	A-field, address	Primary address 1-250, 0 = No primary address
7	1	51	CI-field, data send, LSB first	0101 0001 ++++ +|++- Data send +---- Mode, 0 = Mode 1 (LSB first)
8	1	01	DIF size, 8 bit integer	0000 0001 | | | | ++++- 8 bit integer | | ++-------- Instantaneous value | +----------- LSB of storage number +------------- No DIFE follows
9	1	7A	VIF for bus address	0111 1010 |+++ ++++- Bus address +------------- No VIFE follows
10	1	xx	New primary address	New primary address, LSB first
11	1	xx	CS checksum, calculated from C field to last data	Checksum on bytes between byte no 5 and byte no 10
12	1	16	Stop charact er	[always same]

6.1.4.3.3 Clear error flags

The error flags that are possible to clear are cleared by sending the following command (all values are hexadecimal):

Byte No	Size (in bytes)	Value	Description	Explanation
1	1	68	Start character	[always same]
2	1	0F	L-field, calculated from C field to last user data	No of bytes between byte no 5 and byte no 19
3	1	0F	L-field, repeated	[same as above]
4	1	68	Start character	[always same]
5	1	53/73	C-field, SND_UD	01x1 0011 | | | | ++++- Function, 3 = Send user data | | | +------- FCV, 1 = FCB is valid | | +--------- FCB, Alternate for successive transfers | +----------- Direction, 1 = to meter +------------- [always 0]
6	1	xx	A-field, address	Primary address 1-250, 0 = No primary address
7	1	51	CI-field, data send, LSB first	0101 0001 ++++ +|++- Data send +---- Mode, 0 = Mode 1 (LSB first)
8	1	07	DIF size, 64 bit integer	0000 0111 | | | | ++++- 64 bit integer | | ++-------- Instantaneous value | +----------- LSB of storage number +------------- No DIFE follows
9-10	2	FD97	Error codes	1111 1011 ++++ ++++- True VIF according to table $FD follows in VIFE 1001 0111 |+++ ++++- Error flags, binary +------------- VIFE will follow
11	1	07	Clear	0000 0111 |+++ ++++- Clear data +------------- No VIFE follows
12-19	8	xxxxxxxx xxxx xxxx	Error flags, represented binary	Error flags, as defined by ABB
20	1	xx	CS checksum, calculated from C field to last data	Checksum on bytes between byte no 5 and byte no 19
21	1	16	Stop character	[always same]

6.1.4.3.4 Disable error flags

The error flags that are possible to disable are disabled by sending the following command (all values are hexadecimal):

Byte No	Size (in bytes)	Value	Description	Explanation
1	1	68	Start character	[always same]
2	1	0F	L-field, calculated from C field to last user data	No of bytes between byte no 5 and byte no 19
3	1	0F	L-field, repeated	[same as above]
4	1	68	Start character	[always same]
5	1	53/73	C-field, SND_UD	01x1 0011 | | | | ++++- Function, 3 = Send user data | | | +------- FCV, 1 = FCB is valid | | +--------- FCB, Alternate for successive transfers | +----------- Direction, 1 = to meter +------------- [always 0]
6	1	xx	A-field, address	Primary address 1-250, 0 = No primary address
7	1	51	CI-field, data send, LSB first	0101 0001 ++++ +|++- Data send +---- Mode, 0 = Mode 1 (LSB first)
8	1	07	DIF size, 64 bit integer	0000 0111 | | | | ++++- 64 bit integer | | ++-------- Instantaneous value | +----------- LSB of storage number +------------- No DIFE follows
9-10	2	FD97	Error codes	1111 1011 ++++ ++++- True VIF according to table $FD follows in VIFE 1001 0111 |+++ ++++- Error flags, binary +------------- VIFE will follow
11	1	0D	Disable	0000 1101 |+++ ++++- Delete data from readout +------------- No VIFE follows
12-19	8	xxxxxxxx xxxxxxxx	Error flags, represented binary	Error flags, as defined by ABB
20	1	xx	CS checksum, calculated from C field to last data	Checksum on bytes between byte no 5 and byte no 19
21	1	16	Stop character	[always same]

6.1.4.3.5 Reset power fail counter

The power fail counter is reset by sending the following command (all values are hexadecimal):

Byte No	Size (in bytes)	Value	Description	Explanation
1	1	68	Start character	[always same]
2	1	07	L-field, calculated from C field to last user data	No of bytes between byte no 5 and byte no 11
3	1	07	L-field, repeated	[same as above]
4	1	68	Start character	[always same]
5	1	53/73	C-field, SND_UD	01x1 0011 |			++++- Function, 3 = Send user data |		+------- FCV, 1 = FCB is valid |	+--------- FCB, Alternate for successive transfers | +----------- Direction, 1 = to meter +------------- [always 0]
6	1	xx	A-field, address	Primary address 1-250, 0 = No primary address
7	1	51	CI-field, data send, LSB first	0101 0001 ++++ +|++- Data send +---- Mode, 0 = Mode 1 (LSB first)
8	1	00	DIF size, no data	0000 0000 				++++- No data 		++-------- Instantaneous value 	+----------- LSB of storage number +------------- No DIFE follows
9-10	2	FF98	Power fail counter	1111 1111 |+++ ++++- VIFE and data is manufacturer specific +------------- VIFE will follow 1001 1000 |+++ ++++- Power fail counter (decided by ABB) +------------- VIFE follows
11	4	07	VIFE, clear counter	0000 0111 |+++ ++++- Clear data +------------- No VIFE follows
12	1	xx	CS checksum, calculated from C field to last data	Checksum on bytes between byte no 5 and byte no 11
13	1	16	Stop character	[always same]

6.1.4.3.6 Enable / disable local reset

In resettable meters, if allowed (factory setting), it is possible to enable/disable the possibility to reset the meter via the button by sending the following command (all values are hexadecimal):

Byte No	Size (in bytes)	Value	Description	Explanation
1	1	68	Start character	[always same]
2	1	08	L-field, calculated from C field to last user data	No of bytes between byte no 5 and byte no 11
3	1	08	L-field, repeated	[same as above]
4	1	68	Start character	[always same]
5	1	53/73	C-field, SND_UD	01x1 0011 | | | | ++++- Function, 3 = Send user data | | | +------- FCV, 1 = FCB is valid | | +--------- FCB, Alternate for successive transfers | +----------- Direction, 1 = to meter +------------- [always 0]
6	1	xx	A-field, address	Primary address 1-250, 0 = No primary address
7	1	51	CI-field, data send, LSB first	0101 0001 ++++ +|++- Data send +---- Mode, 0 = Mode 1 (LSB first)
8	1	01	DIF size, 8 bit interger	0000 0000 | | | | ++++- 8 bit interger | | ++-------- Instantaneous value | +----------- LSB of storage number +------------- No DIFE follows
9-11	3	FFF908	Button reset right	1111 1111 |+++ ++++- VIFE and data is manufacturer specific +------------- VIFE will follow 1111 1001 |+++ ++++- Manufacturer specific VIFE extension +------------- VIFE follows 0000 1000 |+++ ++++- Button reset right (decided by ABB) +------------- VIFE follows
12	4	xx	Button reset enable/disable	0/1 : Button reset disabled/enabled
13	1	xx	CS checksum, calculated from C field to last data	Checksum on bytes between byte no 5 and byte no 11
14	1	16	Stop character	[always same]

6.1.5 ERROR/INFORMATION FLAGS

Below in the table are all bits sent out in the M-bus Error/Information flags specified.

Bits not used by the ODINsingle meter are always set to 0

Byte	Bit	Code	Type	Description
1	0	100	Checksum	Checksum error tariff 1, active energy
	1	101		Checksum error tariff 2, active energy (not used)
	2	102		Checksum error tariff 3, active energy (not used)
	3	103		Checksum error tariff 4, active energy (not used)
	4	104		Checksum error total energy, active energy
	5	105		Checksum error monthly values, active energy (not used)
	6	106		Checksum error on critical non energy block
	7	107		Checksum error on non critical non energy block
2	0	200	Checksum	Checksum error tariff 1, reactive energy (not used)
	1	201		Checksum error tariff 2, reactive energy (not used)
	2	202		Checksum error tariff 3, reactive energy (not used)
	3	203		Checksum error tariff 4, reactive energy (not used)
	4	204		Checksum error total energy, reactive energy (not used)
	5	205		Checksum error monthly values, reactive energy (not used)
	6	206		(not used)
	7	207		(not used)
3	0	300	Installation	Any of U1-U3 voltage above meter specification
	1	301		Any of U1-U3 voltage below meter specification
	2	302		Any of I1-I3 current above meter specification
	3	303		Frequency outside meter specification
	4	304		U1 missing (not used)
	5	305		U2 missing (not used)
	6	306		U3 missing (not used)
	7	307		Phase connected to neutral (not used)
4	0	400	Installation	Negative power element 1 (not used)
	1	401		Negative power element 2 (not used)
	2	402		Negative power element 3 (not used)
	3	403		Negative power total
	4	404		External data input signal out of specification (not used)
	5	405		(not used)
	6	406		(not used)
	7	407		(not used)

Byte	Bit	Code	Type	Description
5	0	500	Configuration	Pulses merged
	1	501		Date not set (not used)
	2	502		Time not set (not used)
	3	503		Tariffs set wrong (not used)
	4	504		(not used)
	5	505		(not used)
	6	506		(not used)
	7	507		(not used)
6	0	600	Info	Single phase meter
	1	601		Two element meter (not used)
	2	602		Three element meter (not used)
	3	603		Active energy
	4	604		Reactive energy (not used)
	5	605		(not used)
	6	606		(not used)
	7	607		(not used)
7	0	700	Hardware	Main EEPROM failed
	1	701		Extended EEPROM failed (not used)
	2	702		Vref is not VDD/2
	3	703		Temperature sensor error
	4	704		RTC-circuit error (not used)
	5	705		MCU-circuit error
	6	706		(not used)
	7	707		(not used)
8	0	800	Internal	Internal system variable 1 (ABB use only)
	1	801		Internal system variable 2 (ABB use only)
	2	802		Internal system variable 3 (ABB use only)
	3	803		Internal system variable 4 (ABB use only)
	4	804		Internal system variable 5 (ABB use only)
	5	805		Internal system variable 6 (ABB use only)
	6	806		Internal system variable 7 (ABB use only)
	7	807		Internal system variable 8 (ABB use only)

6.1.5.1 Communication settings

If communication with primary addressing is used the primary address is set via communication (see 6.1.4.3.2).

7 ACCESSORIES

Accessory	ABB part number
Serial Comm. Adapter (M-Bus)	2CMA 137 090 R1000
Serial Comm. Adapter (RS232)	2CMA 137 091 R1000
Serial Comm. Adapter (Ethernet) CEM 05000	2CMA 137 099 R1000
Serial Comm. Adapter (LON PLC, A – band) CAL 05000	2CMA 137 100 R1000
Serial Comm. Adapter (LON PLC, C – band) CCL 06000	2CMA 137 103 R1000
Serial Comm. Adapter (GSM/GPRS) CGX 05000	2CMA 137 104 R1000

8 SERVICE AND MAINTENANCE

8.1 RECALIBRATION

It should not be necessary to recalibrate the meter during its lifetime as it is an electronic meter with no moving parts and electronics, voltage and current sensors that do not naturally degrade or change with time under specified environmental conditions. If degradation in the accuracy is observed the meter has probably been partly damaged (for example due to lightning strike or extreme environmental conditions etc) and should be sent for repair or exchanged.

8.2 CLEANING

If the meter is dirty and needs to be cleaned, use lightly moistened tissue with water based mild detergent. Make sure no liquid goes into the meter as this could damage the meter.