Domo M M-Bus Protocol Specification

Version 1.0

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Content

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1. General M-Bus commands
1.1 Introduction
This document describes the M-Bus protocol used to communicate with Domo M sensor. All command examples are in hexadecimal format (e.g. 10 means 0x10 hex).

1.2 M-Bus Protocol
All bytes transmitted over the M-bus have the format 8E1:

1	8	1	1
Start bit	Data bits	Parity bit (even)	Stop bit

For communication three different telegram types are used. These are:

1. Single character E5 (only used by slave)
2. Short frame (only used by master)
3. Long frame (used by both master and slave)

When multiple byte fields have to be transmitted, LSB-first byte ordering convention is used.

1.3. Single character
The single character E5 (CON_ACK) is only used by the meter. It serves as an acknowledgement of the reception of a valid frame (it does not say anything about whether the command was accepted and executed or not).

1.4. M-Bus fields
Common M-Bus used fields are summarised in the following table. For any further explanation, please refer to European norm EN 13757-3 (Communication systems for and remote reading of meters – Part 3: Dedicated application layer), or refer to the M-Bus protocol (http://www.m-bus.com/):

„C“ field	Command field: 1 byte
„A“ field	Primary address field: 1 byte
„CI“ field	Type of application data to be transmitted: 1 byte
“csum”	M-Bus checksum: 1 byte
Long frame identifier	Start byte, long frame: 68 (1 byte)
Short frame identifier	Start byte, short frame: 10 (1 byte)
Stop byte	Stop byte, all frames: 16 (1 byte)
4-byte type A serial number	Secondary M-Bus address, lsb first (4 bytes)
2-byte manufacturer code	Manufacturer code as in EN 61107 (three uppercase letters codified in 2 bytes)
Medium code	Medium type as in EN 13757-3: (1 byte)

1.5 SND_NKE
Deselection of a meter after selection by its secondary address.

Short frame identifier	10
„C“ field	40
„A“ field	primary address
Checksum	csum
Stop byte	16

Meter answer to command: E5.

1.6 Application reset

Deselects the device (secondary addressing).

Long frame identifier	68
Length bytes	03
Length bytes	03
Long frame identifier	68
„C“ field	53 or 73
„A“ field	primary address
„CI“ field	50
Checksum	csum
Stop byte	16

Meter answer to command: E5.

1.7 Set primary M-Bus address

Changes the primary address to a new M-bus primary address

Long frame identifier	68
Length bytes	06
Length bytes	06
Long frame identifier	68
„C“ field	53 or 73
„A“ field	primary address
„CI“ field	51
Set primary M-bus address command	01
	7A
New primary address	new primary address
Checksum	csum
Stop byte	16

Meter answer to command: E5.

1.8 Select meter by secondary address

Long frame identifier	68
Length bytes	0B
Length bytes	0B
Long frame identifier	68
„C“ field	53 or 73
„A“ field	FD
„CI“ field	52
4-byte BCD secondary address (LSB first)	S_{low}… S_{high}
2-byte manufacturer code (LSB first)	Man_{low}… Man_{high}
Meter version number	Ver
Medium code	Med
Checksum	csum
Stop byte	16

The placeholder „F“ can be used at any decimal place of the serial number.
The placeholder "FF" can be used for "medium code", „meter version number" and „manufacturer code"
Meter answer to command: E5, if the secondary address is correct and found.

1.9 Set date and time

Long frame identifier	68
Length bytes	09
Length bytes	09
Long frame identifier	68
„C“ field	53 or 73
„A“ field	primary address
„CI“ field	51
DIF	04
VIF	6D
4-byte „type F“ date and time	d_{low}… d_{high}
Checksum	csum
Stop byte	16

Meter answer to command: E5.
Date/time is represented as 4-byte „type F“ format as defined in EN13757-3
Note: Changing the date may influence the billing period and monthly values.

1.10 Change Baudrate

Changes the speed of the M-Bus interface. Possible values: 300, 2400 and 9600 baud. Standard is 2400 baud.

Long frame identifier	68
Length bytes	03
Length bytes	03
Long frame identifier	68
„C“ field	53 or 73
„A“ field	primary address
„CI“ field	B8 for 300 baud BB for 2400 baud BD for 9600 baud
Checksum	csum
Stop byte	16

Meter answer to command: E5 at the old baud rate

2. Data reading
2.1 REQ_UD2 command

Command to request data from the meter

Short frame identifier	10
„C“ field	5B or 7B
„A“ field	primary address
Checksum	csum
Stop byte	16

Response to a REQ_UD2 command.

Long frame identifier	68
Length bytes	len
Length bytes	len
Long frame identifier	68
„C" field	08
„A" field	primary address
„CI" field	72
4-byte secondary address (LSB first)	$i_{low}\dots i_{high}$
2-byte manufacturer code (LSB first)	AE4C
Meter version number	Ver
Medium code	Med
Access Number	AccNo
M-Bus Status	Status
Signature	00
	00
Data bytes read (see below)	$b_1\dots b_n$
Checksum	csum
Stop byte	16

The "Access Number" is a progressive counter incremented for each frame sent by the meter. The "M-Bus Status" is generally "00". In case of an error (for example low battery) in the meter the current error code will be sent accordingly to EN13757-3.

Definition of the data bytes:

Function/Field	**Byte description**	**Byte sample**
Water meter serial number	DIF: 0E (actual reading, 12 digit BCD)	0E
	VIF: 78 (fabrication number)	78
	value (e.g. serial 1234567890)	90
		78
		56
		34
		12
		00
Actual date/time	DIF: 04 (actual reading, 4 bytes binary)	04
	VIF: 6D (date/time type "F")	6D
	value (e.g. 2013-10-11 14:52:00 = 1AAB0E34)	34
		0E
		AB
		1A
Actual reading volume	DIF: 04 (actual reading, 4 bytes binary)	04
	VIF: 13 (volume, liter)	13
	value (e.g. 54321 litres = 0000D431)	31
		D4
		00
		00

Actual back flow volume	DIF: 04 (actual reading, 4 bytes binary)	04
	VIF: 93 (volume, liter + VIFE extension)	93
	VIFE: 3C (accumulation of value only in backward flow)	3C
	value (e.g. 0 l)	E8
		03
		00
		00
Periodic reading volume (T1)	DIF: 44 (storage T1 value, 4 bytes binary)	44
	VIF: 13 (volume, liter)	13
	value (e.g. 0 l)	00
		00
		00
		00
Periodic reading date (T1)	DIF: 42 (storage T1 value, 2 bytes binary)	42
	VIF: 6C (date type G)	6C
	value (e.g. 2000-01-15 = 010F)	0F
		01
Monthly reading volume (T2)	DIF: 84 (storage T2 value, 4 bytes binary + DIFE extension)	84
	DIFE: 01 (storage T2)	01
	VIF: 13 (volume, liter)	13
	value (e.g. 0 l)	00
		00
		00
		00
Monthly reading date (T2)	DIF: 82 (storage T2 value, 2 bytes binary + DIFE extension)	82
	DIFE: 01 (storage T2)	01
	VIF: 6C (date type G)	6C
	value (e.g. 2000-01-01 = 0101)	01
		01
Monthly reading volume (T3)	DIF: C4 (storage T3 value, 4 bytes binary + DIFE extension)	C4
	DIFE: 01 (storage T3)	01
	VIF: 13 (volume, liter)	13
	value (e.g. 0 l)	00
		00
		00
		00
Monthly reading date (T3)	DIF: C2 (storage T3 value, 2 bytes binary + DIFE extension)	C2
	DIFE: 01 (storage T3)	01
	VIF: 6C (date type G)	6C
	value (e.g. 2000-02-01 = 0201)	01
		02
Monthly reading volume (T4)	DIF: 84 (storage T4 value, 4 bytes binary + DIFE extension)	84
	DIFE: 02 (storage T4)	02
	VIF: 13 (volume, liter)	13
	value (e.g. 0 l)	00
		00
		00
		00

Monthly reading date (T4)	DIF: 82 (storage T4 value, 2 bytes binary + DIFE extension)	82
	DIFE: 02 (storage T4)	02
	VIF: 6C (date type G)	6C
	value (e.g. 2000-03-01 = 0301)	01
		03
Monthly reading volume (T5)	DIF: C4 (storage T5 value, 4 bytes binary + DIFE extension)	C4
	DIFE: 02 (storage T5)	02
	VIF: 13 (volume, liter)	13
	value (e.g. 0 l)	00
		00
		00
		00
Monthly reading date (T5)	DIF: C2 (storage T5 value, 2 bytes binary + DIFE extension)	C2
	DIFE: 02 (storage T5)	02
	VIF: 6C (date type G)	6C
	value (e.g. 2000-04-01 = 0401)	01
		04
Monthly reading volume (T6)	DIF: 84 (storage T6 value, 4 bytes binary + DIFE extension)	84
	DIFE: 03 (storage T6)	03
	VIF: 13 (volume, liter)	13
	value (e.g. 0 l)	00
		00
		00
		00
Monthly reading date (T6)	DIF: 82 (storage T6 value, 2 bytes binary + DIFE extension)	82
	DIFE: 03 (storage T6)	03
	VIF: 6C (date type G)	6C
	value (e.g. 2000-05-01 = 0501)	01
		05
Monthly reading volume (T7)	DIF: C4 (storage T7 value, 4 bytes binary + DIFE extension)	C4
	DIFE: 03 (storage T7)	03
	VIF: 13 (volume, liter)	13
	value (e.g. 0 l)	00
		00
		00
		00
Monthly reading date (T7)	DIF: C2 (storage T7 value, 2 bytes binary + DIFE extension)	C2
	DIFE: 03 (storage T7)	03
	VIF: 6C (date type G)	6C
	value (e.g. 2000-06-01 = 0601)	01
		06
Monthly reading volume (T8)	DIF: 84 (storage T8 value, 4 bytes binary + DIFE extension)	84
	DIFE: 04 (storage T8)	04
	VIF: 13 (volume, liter)	13
	value (e.g. 0 l)	00
		00
		00
		00

Monthly reading date (T8)	DIF: 82 (storage T8 value, 2 bytes binary + DIFE extension)	82
	DIFE: 04 (storage T8)	04
	VIF: 6C (date type G)	6C
	value (e.g. 2000-07-01 = 0701)	01
		07
Monthly reading volume (T9)	DIF: C4 (storage T9 value, 4 bytes binary + DIFE extension)	C4
	DIFE: 04 (storage T9)	04
	VIF: 13 (volume, liter)	13
	value (e.g. 0 l)	00
		00
		00
		00
Monthly reading date (T9)	DIF: C2 (storage T9 value, 2 bytes binary + DIFE extension)	C2
	DIFE: 04 (storage T9)	04
	VIF: 6C (date type G)	6C
	value (e.g. 2000-08-01 = 0801)	01
		08
Monthly reading volume (T10)	DIF: 84 (storage T10 value, 4 bytes binary + DIFE extension)	84
	DIFE: 05 (storage T10)	05
	VIF: 13 (volume, liter)	13
	value (e.g. 0 l)	00
		00
		00
		00
Monthly reading date (T10)	DIF: 82 (storage T10 value, 2 bytes binary + DIFE extension)	82
	DIFE: 05 (storage T10)	05
	VIF: 6C (date type G)	6C
	value (e.g. 2000-09-01 = 0901)	01
		09
Monthly reading volume (T11)	DIF: C4 (storage T11 value, 4 bytes binary + DIFE extension)	C4
	DIFE: 05 (storage T11)	05
	VIF: 13 (volume, liter)	13
	value (e.g. 0 l)	00
		00
		00
		00
Monthly reading date (T11)	DIF: C2 (storage T11 value, 2 bytes binary + DIFE extension)	C2
	DIFE: 05 (storage T11)	05
	VIF: 6C (date type G)	6C
	value (e.g. 2000-10-01 = 0A01)	01
		0A
Monthly reading volume (T12)	DIF: 84 (storage T12 value, 4 bytes binary + DIFE extension)	84
	DIFE: 06 (storage T12)	06
	VIF: 13 (volume, liter)	13
	value (e.g. 0 l)	00
		00
		00
		00

Monthly reading date (T12)	DIF: 82 (storage T12 value, 2 bytes binary + DIFE extension)	82
	DIFE: 06 (storage T12)	06
	VIF: 6C (date type G)	6C
	value (e.g. 2000-11-01 = 0B01)	01
		0B
Monthly reading volume (T13)	DIF: C4 (storage T13 value, 4 bytes binary + DIFE extension)	C4
	DIFE: 06 (storage T13)	06
	VIF: 13 (volume, liter)	13
	value (e.g. 0 l)	00
		00
		00
		00
Monthly reading date (T13)	DIF: C2 (storage T13 value, 2 bytes binary + DIFE extension)	C2
	DIFE: 06 (storage T13)	06
	VIF: 6C (date type G)	6C
	value (e.g. 2000-12-01 = 0C01)	01
		0C
Day/month of next periodic reading	DIF: 02 (actual reading, 2 bytes binary)	02
	VIF: EC (date type G + VIFE extension)	EC
	VIFE: 7E (future value)	7E
	value (e.g. 2000-01-01 = 0101)	01
		01
Periodicity in months of periodic reading	DIF: 01 (actual reading, 1 bytes binary)	01
	VIF: FD (VIF table extension)	FD
	VIFE: 28 (storage interval months)	28
	value = 12 months	0C
Alarms registers (error flag)	DIF: 02 (actual reading, 2 bytes binary)	02
	VIF: FD (VIF table extension)	FD
	VIFE: 17 (error flag)	17
	value (e.g. 0)	00
		00
Firmware version	DIF: 02 (actual reading, 2 bytes binary)	02
	VIF: FD (VIF table extension)	FD
	VIFE: 0E (Firmware version number)	0E
	value (e.g. 1.2)	02
		01
Firmware Checksum	DIF: 02 (actual reading, 2 bytes binary)	02
	VIF: FD (VIF table extension)	FD
	VIFE: 0F (Software version number)	0F
	value (e.g. 0xABCD)	CD
		AB

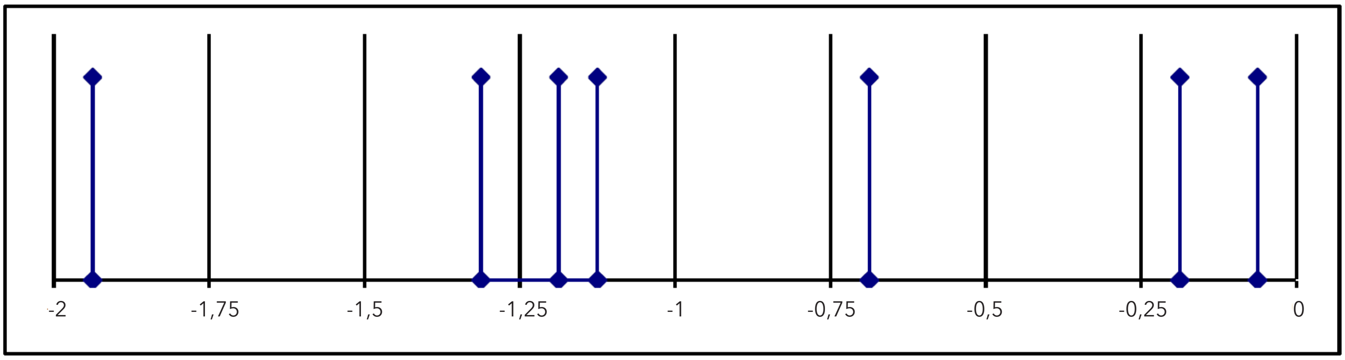
2.2 Alarms registers (Error flags)

LSB	bit 7: Leak currently detected
	bit 6: Leak previously detected
	bit 5: Firmware Checksum error
	bit 4: No consumption currently detected
	bit 3: No consumption previously detected
	bit 2: (unused)
	bit 1: (unused)
	bit 0:(unused)
MSB	bit 7: Backflow currently detected
	bit 6: Backflow previously detected
	bit 5: (unused)
	bit 4: (unused)
	bit 3: (unused)
	bit 2: (unused)
	bit 1: (unused)
	bit 0: (unused)

3. Alarms descriptions
3.1 Suspected leakage alarm algorithm

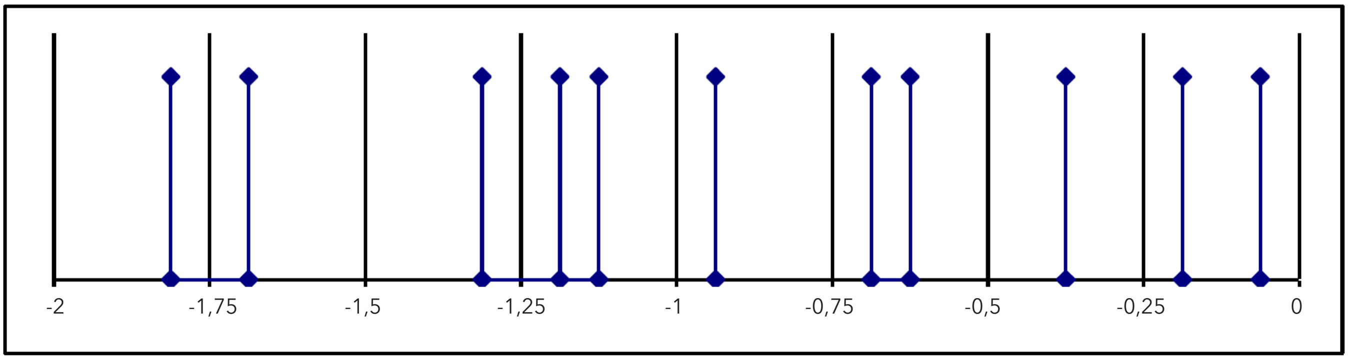
The suspected leakage alarm was created to provide the user with a tool which, if possible, can discover any probable leaks (water leakage as far as water meters are concerned, or, with other meters, constant abnormal consumption). The device implements the following calculation algorithm to establish the existence of a suspected leak:

The period within the last 48 hours is divided into 15-minute time intervals. If inside at least one of these intervals **no** pulse whatsoever has been detected, then the suspected leak does not exist.



Example: some 15 min. intervals are without pulses: suspected leak not present

If at least one pulse is detected in **all** these intervals, then the suspected leakage alarm is present.



Example: all the intervals have a minimum of one pulse: the suspected leakage alarm is activated

The algorithm used by the device is only one of the algorithms which can be devised: moreover, it is not possible to establish the existence of a leak only by analysing the consumption (for example if a meter is located at the entry of a public fountain, the leak alarm would be constantly active). For this reason the term “suspected” leakage is used.

An efficient use of the suspected leakage alarm greatly depends on the mechanical meter’s pulse factor. Indeed the leak algorithm reveals the presence of a “constant” consumption of at least 1 pulse every 15 minutes. This means that the minimum amount of water lost in the leak is of 4 pulses per hour. Since the pulse factor is 1 pulse every litre, then the minimum traceable leak is of 4 l/h.

3.2. Firmware checksum error algorithm

The checksum error flag activates when the firmware checksum calculation does not match the expected value and usually indicates a device malfunctioning.
The calculation is carried out at the 12 p.m. backup.

3.3. No Consumption Alarm Algorithm

If the meter do not detects any pulse for more than 30 days then the No Consumption alarm bits (currently and previously detected) are set.
Whenever the meter counts again, the No Consumption currently detected alarm bit resets (while the previously still holds). Both alarm bits can be reset with the reset alarm command (the same command used to reset other alarm bits).

3.4. Backflow Alarm algorithm

When the meter counts in the backward direction continuously for more than the threshold (100 liters), the backflow alarm bits (currently and previously detect) are set.
Whenever the meter counts again in the forward direction, the Backflow currently detected alarm bit resets (while the previously still holds). Both alarm bits are reset with the reset alarm command.

EMEA & AP Sales Contact Information

EMEA Locations

Sensus España, S.A.U.
Av. Dels Vents, 9 Esc. A 3° 4ª
08917 Badalona (Barcelona), Spain
+34-93-460-10-64

Sensus UK Systems Ltd
3 Lindenwood, Crockford Lane
Chineham Business Park
Basingstoke, Hampshire RG24 8QY
+44-1794-526-100

Sensus Italia s.r.l.
Via Gioacchino Rossini, 1/A
I-20045 Lainate (MI), Italy
+39-02-61291861

Sensus SPA
B.P. 02 Route de Batna
El-Eulma- Wilaya de Sétif
Algeria
+213-36-8749-72

Xylem Water Solutions South Africa (Pty) Ltd
Plumbago Business Park
3A Spier Street, Glen Erasmia
Kempton Park, 1619
+27 11 966 9300

Xylem Water Solutions Deutschland GmbH
Bayernstrasse 11
30855 Langenhagen, Germany
+49-511-7800-0

Sensus GmbH Hannover
Meineckestrasse 10
30880 Laatzen, Germany
+49-5102-74-0

Sensus GmbH Ludwigshafen
Industriestrasse 16
67063 Ludwigshafen, Germany
+49-621-6904-1000

Sensus France SAS
Parc des Aqueducs
Chemin du Favier CD42
69230 Saint Genis Laval
France
+33 4.72.01.85.65

Xylem Česká republika spol. s r.o.
Walterovo náměstí 329/3
158 Prague 5 – Jinonice
Czech Republic
+420 608710211

Sensus Maroc S.A.
23 Lot Beau fruit II
Zone industrielle
12013 Ain Atiq, Maroc
Rabat, Morocco
+212-538-02-32-50 or
+212-661-44-35-39

Sensus Slovensko a.s.
Dr. Alberta Schweitzera 194
91601 Stara Tura, Slovakia
+421 (0)327753939

Sensus Polska Sp. z o.o.
ul. Mazowiecka 63/65
Torun, Poland 87-100
+48-56-654-3303

Asia Pacific Locations

Sensus Metering Systems (Fuzhou) Co., Ltd.
#4 & #5 Building
Tieling North Road
Economic and Technological
Development Zone
Minhou, Fuzhou. 350101,
P.R. China
+86-591-2206-0676

Xylem Water Solutions Singapore Pte Ltd
3A International Business Park,
Tower B, #10-10/18
ICON@IBP, Singapore 609935
+65-6507-6999

Xylem Water Solutions India Pvt. Ltd. - Mumbai
Thane, India
7th Floor, Coral Square, Opp.
Suraj Water Park, Vijay Garden Naka,
Ghodbunder Road
Thane West, Maharashtra 400607, India
+91-22-62644300