INTEGRA METERING

CALEC® ST III

Standard & Smart

Multi-protocol heating and cooling energy calculator

Protocol description LoRaWAN

Contents

Legal notice

Document release index

Version	Date	Modifications(s)
01	18.05.2021	First release
02	19.05.2021	Correction in the data sequences
03	22.09.2021	Since FW > 3.01.05 ; Frame content aligned CALEC STII & CALEC STIII
04	10.07.2023	Adding new data SET 8 ; additional information for decoding

Original instructions

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The figures and information in these instructions are subject to technical changes that become necessary to improve the product.

1. General Information

This manual contains only specific information about the CALEC® ST III with LoRa Interface. Further information can be found in the CALEC® ST III technical documentation (Installation guide, User manual or Technical datasheet).

REFERENCE

Additional documents can be found on the following website:

CALEC® ST III Standard & Smart INTEGRA Metering (integra-metering.com)

For information about the LoRaWAN specification, see : LoRaWAN for Developers - LoRa Alliance® (lora-alliance.org)

2. CALEC® ST III LoRa Information

LoRaWAN is an innovation that offers many advantages over conventional radio transmission technologies. The main advantages of this technology are its enormous range and low energy consumption. A disadvantage, however, is that no large amounts of data can be transmitted. Therefore, it is mandatory to select properly the right settings in terms of data transmission.

CALEC ST III offers various data sets (See below table) and can be freely selected.

In case of difficulties of communication, "Compact Frame" Mode is a preferable solution, where data is compacted and result to a shorted frame length, therefore a better radio link.

Notes:

- In "Standard Frame" mode, if the device are below to DR_3, to fulfil automatically LoRaWAN specification, the device switch to the SET 8 frame instead of the selected one.
- The SET8 is the most efficient frames, which contains all major information from the measurement and also easy to be managed with IoT Platform using JavaScript for instance.
- For selection SET1 to SET7, it's highly recommended to use compact frame setting, because with limited SF (in case of standard frame) performance is limited (and not sufficient for public networks).
- The SET8 is only available with CALEC STIII FW version > 3.1.09

3. Standard mode Variant

The table below describes all dataset with all transmitted information.

		Minimal Bytes	Maximal Bytes	Value	Remark	Include in type
Message header (always transmitted during transmission)	L-Field	1	1	LEN	Number of following bytes	All
	C-Field	1	1	0x44	Specification of the message form	All
					(Fix 0x44) = SEND/NO REPLY	
	M-Field	2	2	0x25b4	Manufacturer	All
				(IMT)		
	S/N Field	4	4	IDENT	Serial number/fabrication number	All
	Version	1	1	DEV	Device type (from Calculator)	All
	Medium	1	1	MED	Device type	
					0x04 = Return (Warm water)	All except C2, C3
					0x0c = Flow	Not used
					0x07 = Water	C2, C3
	CI-Field	1	1	0x7A	Short Header	All
	Access-Counter	1	1	ACC	Access counter, increment per readout	All
	Status	1	1	STAT	Bit 0-2 = not used Bit 3 = permanent error Bit 4 = temporary error Bit 5-7 = not used (Status according to EN13757)	All
	Signature	2	2	0000h	Not used	All
	Sum	**15**	**15**			
SET 1 (Default, Minimal set):						
Energy reading	DIF	1	1	0x04		All except C2, C3
	VIF	1	2		Depends on Unit:	All except C2, C3
				0x03	0.001 kWh (10^0 Wh)	
				0x04	0.01 kWh (10^1 Wh)	
				0x05	0.1 kWh (10^2 Wh)	
				0x06	0.001MWh / 1 kWh (10^3 Wh)	
				0x07	0.01 MWh (10^4 Wh)	
				0xfb00	0.1 MWh (10^{-1} MWh)	
				0xfb01	1 MWh (10^0 MWh)	
				0x0b	0.001 MJ (10^3 J)	
				0x0c	0.01 MJ (10^4 J)	
				0x0d	0.1 MJ (10^5 J)	
				0x0e	0.001 GJ / 1 MJ (10^6 J)	
				0x0f	0.01 GJ (10^7 J)	
				0xfb08	0.1 GJ (10^{-1} GJ)	
				0xfb09	1 GJ (10^0 GJ)	
				0x803d	0.001 kBTU (10^{-3} kBTU)	
				0x813d	0.01 kBTU(10^{-2} kBTU)	
				0x823d	0.1 kBTU(10^{-1} kBTU)	
				0x833d	0.001 MBTU / 1 kBTU (10^0 kBTU)	
				0x843d	0.01 MBTU (10^1 kBTU)	

				0x853d	0.1 MBTU (10^5 kBTU)	
				0x863d	1 MBTU (10^6 kBTU)	
	Value	4	4	INT4	(Energy reading pos. / neg.)	All except C2, C3
Current Date and Time (Timestamp)	DIF	1	1	0x04		all
	VIF	1	1	0x6d		all
	Value	4	4	INT4	MBus typ F format	I
Fabrication number	DIF	1	1	0x0c		all
	VIF	1	1	0x78		all
	VALUE	4	4	BCD8		all
	Sum	**33**	**34**		incl. Funk Header	
SET 2:						
Main Energy	DIF	1	1	0x04		All except C2, C3
	VIF	1	2		Depends on Unit:	All except C2, C3
				0x03	0.001 kWh (10^0 Wh)	
				0x04	0.01 kWh (10^1 Wh)	
				0x05	0.1 kWh (10^2 Wh)	
				0x06	0.001MWh / 1 kWh (10^3 Wh)	
				0x07	0.01 MWh (10^4 Wh)	
				0xfb00	0.1 MWh (10^{-1} MWh)	
				0xfb01	1 MWh (10^0 MWh)	
				0x0b	0.001 MJ (10^3 J)	
				0x0c	0.01 MJ (10^4 J)	
				0x0d	0.1 MJ (10^5 J)	
				0x0e	0.001 GJ / 1 MJ (10^6 J)	
				0x0f	0.01 GJ (10^7 J)	
				0xfb08	0.1 GJ (10^{-1} GJ)	
				0xfb09	1 GJ (10^0 GJ)	
				0x803d	0.001 kBTU (10^{-3} kBTU)	
				0x813d	0.01 kBTU(10^{-2} kBTU)	
				0x823d	0.1 kBTU(10^{-1} kBTU)	
				0x833d	0.001 MBTU / 1 kBTU (10^0 kBTU)	
				0x843d	0.01 MBTU (10^1 kBTU)	
				0x853d	0.1 MBTU (10^5 kBTU)	
				0x863d	1 MBTU (10^6 kBTU)	
	Value	4	4	INT4	(Energy reading pos. / neg.)	All except C2, C3
Flow [l/h]	DIF	1	1	0x05		All except C1
	VIF	1	1	0x3b		All except C1
	Value	4	4	Float		All except C1
Flow temperature [°C]	DIF	1	1	0x05		All except C2, C3
	VIF	1	1	0x5b		All except C2, C3
	Value	4	4	Float		All except C2, C3
Return temperature [°C]	DIF	1	1	0x05		All except C2, C3
	VIF	1	1	0x5f		All except C2, C3
	Value	4	4	Float		All except C2, C3

Current Date and Time (TimeStamp)	DIF	1	1	0x04		all
	VIF	1	1	0x6d		all
	Value	4	4	INT4	MBus typ F format	all
Fabrication number	DIF	1	1	0x0c		all
	VIF	1	1	0x78		all
	VALUE	4	4	BCD8		all
	Sum	**51**	**52**		incl. Funk Header	
SET 3:						
Energy reading	DIF	1	1	0x04		All except C2, C3
	VIF	1	2		Depends on Unit:	All except C2, C3
				0x03	0.001 kWh (10^0 Wh)	
				0x04	0.01 kWh (10^1 Wh)	
				0x05	0.1 kWh (10^2 Wh)	
				0x06	0.001MWh / 1 kWh (10^3 Wh)	
				0x07	0.01 MWh (10^4 Wh)	
				0xfb00	0.1 MWh (10^{-1} MWh)	
				0xfb01	1 MWh (10^0 MWh)	
				0x0b	0.001 MJ (10^3 J)	
				0x0c	0.01 MJ (10^4 J)	
				0x0d	0.1 MJ (10^5 J)	
				0x0e	0.001 GJ / 1 MJ (10^6 J)	
				0x0f	0.01 GJ (10^7 J)	
				0xfb08	0.1 GJ (10^{-1} GJ)	
				0xfb09	1 GJ (10^0 GJ)	
				0x803d	0.001 kBTU (10^{-3} kBTU)	
				0x813d	0.01 kBTU(10^{-2} kBTU)	
				0x823d	0.1 kBTU(10^{-1} kBTU)	
				0x833d	0.001 MBTU / 1 kBTU (10^0 kBTU)	
				0x843d	0.01 MBTU (10^1 kBTU)	
				0x853d	0.1 MBTU (10^5 kBTU)	
				0x863d	1 MBTU (10^6 kBTU)	
	Value	4	4	INT4	(Energy reading pos. / neg.)	All except C2, C3
Energy Tariff 1	DIF	2	2	0x84, 0x10		C4, C7, C9, CC
	VIF	1	2		Depends on Unit:	C4, C7, C9, CC
				0x03	0.001 kWh (10^0 Wh)	
				0x04	0.01 kWh (10^1 Wh)	
				0x05	0.1 kWh (10^2 Wh)	
				0x06	0.001MWh / 1 kWh (10^3 Wh)	
				0x07	0.01 MWh (10^4 Wh)	
				0xfb00	0.1 MWh (10^{-1} MWh)	
				0xfb01	1 MWh (10^0 MWh)	
				0x0b	0.001 MJ (10^3 J)	
				0x0c	0.01 MJ (10^4 J)	
				0x0d	0.1 MJ (10^5 J)	
				0x0e	0.001 GJ / 1 MJ (10^6 J)	
				0x0f	0.01 GJ (10^7 J)	
				0xfb08	0.1 GJ (10^{-1} GJ)	

				0xfb09	1 GJ (10^0 GJ)	
				0x803d	0.001 kBTU (10^{-3} kBTU)	
				0x813d	0.01 kBTU(10^{-2} kBTU)	
				0x823d	0.1 kBTU(10^{-1} kBTU)	
				0x833d	0.001 MBTU / 1 kBTU (10^0 kBTU)	
				0x843d	0.01 MBTU (10^1 kBTU)	
				0x853d	0.1 MBTU (10^5 kBTU)	
				0x863d	1 MBTU (10^6 kBTU)	
	Value	4	4	INT4		C4, C7, C9, CC
Energy Tariff 2	DIF	2	2	0x84, 0x20		C7, CC
	VIF	1	2		Depends on Unit:	C7, CC
				0x03	0.001 kWh (10^0 Wh)	
				0x04	0.01 kWh (10^1 Wh)	
				0x05	0.1 kWh (10^2 Wh)	
				0x06	0.001MWh / 1 kWh (10^3 Wh)	
				0x07	0.01 MWh (10^4 Wh)	
				0xfb00	0.1 MWh (10^{-1} MWh)	
				0xfb01	1 MWh (10^0 MWh)	
				0x0b	0.001 MJ (10^3 J)	
				0x0c	0.01 MJ (10^4 J)	
				0x0d	0.1 MJ (10^5 J)	
				0x0e	0.001 GJ / 1 MJ (10^6 J)	
				0x0f	0.01 GJ (10^7 J)	
				0xfb08	0.1 GJ (10^{-1} GJ)	
				0xfb09	1 GJ (10^0 GJ)	
				0x803d	0.001 kBTU (10^{-3} kBTU)	
				0x813d	0.01 kBTU(10^{-2} kBTU)	
				0x823d	0.1 kBTU(10^{-1} kBTU)	
				0x833d	0.001 MBTU / 1 kBTU (10^0 kBTU)	
				0x843d	0.01 MBTU (10^1 kBTU)	
				0x853d	0.1 MBTU (10^5 kBTU)	
				0x863d	1 MBTU (10^6 kBTU)	
	Value	4	4	INT4		C7, CC
Main volume	DIF	1	1	0x04		All except C1
	VIF	1	2		Depends on Unit:	All except C1
				0x13	0.001 m3 (10^{-3} m^3)	
				0x14	0.01 m3 (10^{-2} m^3)	
				0x15	0.1 m3 (10^{-1} m^3)	
				0x16	1 m3 (10^0 m^3)	
				0x903d	0.001 USGAL (10^{-3} USGAL)	
				0x913d	0.01 USGAL (10^{-2} USGAL)	
				0x923d	0.1 USGAL (10^{-1} USGAL)	
				0x933d	1 USGAL (10^0 USGAL)	
	Value	4	4	INT4		All except C1
Flow [l/h]	DIF	1	1	0x05		All except C1
	VIF	1	1	0x3b		All except C1

	Value	4	4	Float		All except C1
Current Date and Time (TimeStamp)	DIF	1	1	0x04		all
	VIF	1	1	0x6d		all
	Value	4	4	INT4	MBus typ F format	all
Fabrication number	DIF	1	1	0x0c		all
	VIF	1	1	0x78		all
	VALUE	4	4	BCD8		all
	Sum	**59**	**63**		incl. Funk Header	
SET 4:						
Main Energy	DIF	1	1	0x04		All except C2, C3
	VIF	1	2		Depends on Unit:	All except C2, C3
				0x03	0.001 kWh (10^0 Wh)	
				0x04	0.01 kWh (10^1 Wh)	
				0x05	0.1 kWh (10^2 Wh)	
				0x06	0.001MWh / 1 kWh (10^3 Wh)	
				0x07	0.01 MWh (10^4 Wh)	
				0xfb00	0.1 MWh (10^{-1} MWh)	
				0xfb01	1 MWh (10^0 MWh)	
				0x0b	0.001 MJ (10^3 J)	
				0x0c	0.01 MJ (10^4 J)	
				0x0d	0.1 MJ (10^5 J)	
				0x0e	0.001 GJ / 1 MJ (10^6 J)	
				0x0f	0.01 GJ (10^7 J)	
				0xfb08	0.1 GJ (10^{-1} GJ)	
				0xfb09	1 GJ (10^0 GJ)	
				0x803d	0.001 kBTU (10^{-3} kBTU)	
				0x813d	0.01 kBTU(10^{-2} kBTU)	
				0x823d	0.1 kBTU(10^{-1} kBTU)	
				0x833d	0.001 MBTU / 1 kBTU (10^0 kBTU)	
				0x843d	0.01 MBTU (10^1 kBTU)	
				0x853d	0.1 MBTU (10^5 kBTU)	
				0x863d	1 MBTU (10^6 kBTU)	
	Value	4	4	INT4	(Energy reading pos. / neg.)	All except C2, C3
Energy Tariff 1	DIF	2	2	0x84, 0x10		C4, C7, C9, CC
	VIF	1	2		Depends on Unit:	C4, C7, C9, CC
				0x03	0.001 kWh (10^0 Wh)	
				0x04	0.01 kWh (10^1 Wh)	
				0x05	0.1 kWh (10^2 Wh)	
				0x06	0.001MWh / 1 kWh (10^3 Wh)	
				0x07	0.01 MWh (10^4 Wh)	
				0xfb00	0.1 MWh (10^{-1} MWh)	
				0xfb01	1 MWh (10^0 MWh)	
				0x0b	0.001 MJ (10^3 J)	
				0x0c	0.01 MJ (10^4 J)	
				0x0d	0.1 MJ (10^5 J)	
				0x0e	0.001 GJ / 1 MJ (10^6 J)	
				0x0f	0.01 GJ (10^7 J)	

				0xfb08	0.1 GJ (10^{-1} GJ)	
				0xfb09	1 GJ (10^{0} GJ)	
				0x803d	0.001 kBTU (10^{-3} kBTU)	
				0x813d	0.01 kBTU(10^{-2} kBTU)	
				0x823d	0.1 kBTU(10^{-1} kBTU)	
				0x833d	0.001 MBTU / 1 kBTU (10^{0} kBTU)	
				0x843d	0.01 MBTU (10^{1} kBTU)	
				0x853d	0.1 MBTU (10^{5} kBTU)	
				0x863d	1 MBTU (10^{6} kBTU)	
	Value	4	4	INT4		C4, C7, C9, CC
Energy Tariff 2	DIF	2	2	0x84, 0x20		C7, CC
	VIF	1	2		Depends on Unit:	C7, CC
				0x03	0.001 kWh (10^{0} Wh)	
				0x04	0.01 kWh (10^{1} Wh)	
				0x05	0.1 kWh (10^{2} Wh)	
				0x06	0.001MWh / 1 kWh (10^{3} Wh)	
				0x07	0.01 MWh (10^{4} Wh)	
				0xfb00	0.1 MWh (10^{-1} MWh)	
				0xfb01	1 MWh (10^{0} MWh)	
				0x0b	0.001 MJ (10^{3} J)	
				0x0c	0.01 MJ (10^{4} J)	
				0x0d	0.1 MJ (10^{5} J)	
				0x0e	0.001 GJ / 1 MJ (10^{6} J)	
				0x0f	0.01 GJ (10^{7} J)	
				0xfb08	0.1 GJ (10^{-1} GJ)	
				0xfb09	1 GJ (10^{0} GJ)	
				0x803d	0.001 kBTU (10^{-3} kBTU)	
				0x813d	0.01 kBTU(10^{-2} kBTU)	
				0x823d	0.1 kBTU(10^{-1} kBTU)	
				0x833d	0.001 MBTU / 1 kBTU (10^{0} kBTU)	
				0x843d	0.01 MBTU (10^{1} kBTU)	
				0x853d	0.1 MBTU (10^{5} kBTU)	
				0x863d	1 MBTU (10^{6} kBTU)	
	Value	4	4	INT4		C7, CC
Main Volume	DIF	1	1	0x04		All except C1
	VIF	1	2		Depends on Unit:	All except C1
				0x13	0.001 m3 (10^{-3} m^3)	
				0x14	0.01 m3 (10^{-2} m^3)	
				0x15	0.1 m3 (10^{-1} m^3)	
				0x16	1 m3 (10^{0} m^3)	
				0x903d	0.001 USGAL (10^{-3} USGAL)	
				0x913d	0.01 USGAL (10^{-2} USGAL)	
				0x923d	0.1 USGAL (10^{-1} USGAL)	
				0x933d	1 USGAL (10^{0} USGAL)	
	Value	4	4	INT4		All except C1
Main Masse	DIF	1	1	0x04		C1
	VIF	1	2		Depends on Unit:	C1

				0x1b	0.001 t (10^{-3} t)	
				0x1c	0.01 t (10^{-2} t)	
				0x1d	0.1 t (10^{-1} t)	
				0x1e	1 t (10^{0} t)	
	Value	4	4	INT4		C1
Power [W]	DIF	1	1	0x05		All except C2, C3
	VIF	1	1	0x2b		All except C2, C3
	Value	4	4	Float		All except C2, C3
Flow [l/h]	DIF	1	1	0x05		All except C1
	VIF	1	1	0x3b		All except C1
	Value	4	4	Float		All except C1
Current Date and Time (TimeStamp)	DIF	1	1	0x04		All
	VIF	1	1	0x6d		All
	Value	4	4	INT4	MBus typ F format	All
Fabrication number	DIF	1	1	0x0c		All
	VIF	1	1	0x78		All
	VALUE	4	4	BCD8		All
	Sum	**71**	**76**		incl. Funk Header	
SET 5:						
Main Energy	DIF	1	1	0x04		All except C2, C3
	VIF	1	2		Depends on Unit:	All except C2, C3
				0x03	0.001 kWh (10^{0} Wh)	
				0x04	0.01 kWh (10^{1} Wh)	
				0x05	0.1 kWh (10^{2} Wh)	
				0x06	0.001MWh / 1 kWh (10^{3} Wh)	
				0x07	0.01 MWh (10^{4} Wh)	
				0xfb00	0.1 MWh (10^{-1} MWh)	
				0xfb01	1 MWh (10^{0} MWh)	
				0x0b	0.001 MJ (10^{3} J)	
				0x0c	0.01 MJ (10^{4} J)	
				0x0d	0.1 MJ (10^{5} J)	
				0x0e	0.001 GJ / 1 MJ (10^{6} J)	
				0x0f	0.01 GJ (10^{7} J)	
				0xfb08	0.1 GJ (10^{-1} GJ)	
				0xfb09	1 GJ (10^{0} GJ)	
				0x803d	0.001 kBTU (10^{-3} kBTU)	
				0x813d	0.01 kBTU(10^{-2} kBTU)	
				0x823d	0.1 kBTU(10^{-1} kBTU)	
				0x833d	0.001 MBTU / 1 kBTU (10^{0} kBTU)	
				0x843d	0.01 MBTU (10^{1} kBTU)	
				0x853d	0.1 MBTU (10^{5} kBTU)	
				0x863d	1 MBTU (10^{6} kBTU)	
	Value	4	4	INT4	(Energy reading pos. / neg.)	All except C2, C3
Energy Tariff 1	DIF	2	2	0x84, 0x10		C4, C7, C9, CC
	VIF	1	2		Depends on Unit:	

				0x03	0.001 kWh (10^0 Wh)	C4, C7, C9, CC
				0x04	0.01 kWh (10^1 Wh)	
				0x05	0.1 kWh (10^2 Wh)	
				0x06	0.001MWh / 1 kWh (10^3 Wh)	
				0x07	0.01 MWh (10^4 Wh)	
				0xfb00	0.1 MWh (10^{-1} MWh)	
				0xfb01	1 MWh (10^0 MWh)	
				0x0b	0.001 MJ (10^3 J)	
				0x0c	0.01 MJ (10^4 J)	
				0x0d	0.1 MJ (10^5 J)	
				0x0e	0.001 GJ / 1 MJ (10^6 J)	
				0x0f	0.01 GJ (10^7 J)	
				0xfb08	0.1 GJ (10^{-1} GJ)	
				0xfb09	1 GJ (10^0 GJ)	
				0x803d	0.001 kBTU (10^{-3} kBTU)	
				0x813d	0.01 kBTU(10^{-2} kBTU)	
				0x823d	0.1 kBTU(10^{-1} kBTU)	
				0x833d	0.001 MBTU / 1 kBTU (10^0 kBTU)	
				0x843d	0.01 MBTU (10^1 kBTU)	
				0x853d	0.1 MBTU (10^5 kBTU)	
				0x863d	1 MBTU (10^6 kBTU)	
	Value	4	4	INT4		C4, C7, C9, CC
Energy Tariff 2	DIF	2	2	0x84, 0x20		C7, CC
	VIF	1	2		Depends on Unit:	C7, CC
				0x03	0.001 kWh (10^0 Wh)	
				0x04	0.01 kWh (10^1 Wh)	
				0x05	0.1 kWh (10^2 Wh)	
				0x06	0.001MWh / 1 kWh (10^3 Wh)	
				0x07	0.01 MWh (10^4 Wh)	
				0xfb00	0.1 MWh (10^{-1} MWh)	
				0xfb01	1 MWh (10^0 MWh)	
				0x0b	0.001 MJ (10^3 J)	
				0x0c	0.01 MJ (10^4 J)	
				0x0d	0.1 MJ (10^5 J)	
				0x0e	0.001 GJ / 1 MJ (10^6 J)	
				0x0f	0.01 GJ (10^7 J)	
				0xfb08	0.1 GJ (10^{-1} GJ)	
				0xfb09	1 GJ (10^0 GJ)	
				0x803d	0.001 kBTU (10^{-3} kBTU)	
				0x813d	0.01 kBTU(10^{-2} kBTU)	
				0x823d	0.1 kBTU(10^{-1} kBTU)	
				0x833d	0.001 MBTU / 1 kBTU (10^0 kBTU)	
				0x843d	0.01 MBTU (10^1 kBTU)	
				0x853d	0.1 MBTU (10^5 kBTU)	
				0x863d	1 MBTU (10^6 kBTU)	
	Value	4	4	INT4		C7, CC
Flow [l/h]	DIF	1	1	0x05		All except C1

	VIF	1	1	0x3b		All except C1
	Value	4	4	Float		All except C1
Flow temperature [°C]	DIF	1	1	0x05		All except C2, C3
	VIF	1	1	0x5b		All except C2, C3
	Value	4	4	Float		All except C2, C3
Return temperature [°C]	DIF	1	1	0x05		All except C2, C3
	VIF	1	1	0x5f		All except C2, C3
	Value	4	4	Float		All except C2, C3
Current Date and Time (Timestamp)	DIF	1	1	0x04		All
	VIF	1	1	0x6d		All
	Value	4	4	INT4	MBus typ F format	All
Fabrication number	DIF	1	1	0x0c		All
	VIF	1	1	0x78		All
	VALUE	4	4	BCD8		All
	Sum	**65**	**68**		incl. Funk Header	
SET 6 (as Set 2, but without flow rate parameter)						
- Main Energy	DIF	1	1	0x04		All except C2, C3
	VIF	1	2		Depends on Unit:	All except C2, C3
				0x03	0.001 kWh (10^0 Wh)	
				0x04	0.01 kWh (10^1 Wh)	
				0x05	0.1 kWh (10^2 Wh)	
				0x06	0.001MWh / 1 kWh (10^3 Wh)	
				0x07	0.01 MWh (10^4 Wh)	
				0xfb00	0.1 MWh (10^{-1} MWh)	
				0xfb01	1 MWh (10^0 MWh)	
				0x0b	0.001 MJ (10^3 J)	
				0x0c	0.01 MJ (10^4 J)	
				0x0d	0.1 MJ (10^5 J)	
				0x0e	0.001 GJ / 1 MJ (10^6 J)	
				0x0f	0.01 GJ (10^7 J)	
				0xfb08	0.1 GJ (10^{-1} GJ)	
				0xfb09	1 GJ (10^0 GJ)	
				0x803d	0.001 kBTU (10^{-3} kBTU)	
				0x813d	0.01 kBTU(10^{-2} kBTU)	
				0x823d	0.1 kBTU(10^{-1} kBTU)	
				0x833d	0.001 MBTU / 1 kBTU (10^0 kBTU)	
				0x843d	0.01 MBTU (10^1 kBTU)	
				0x853d	0.1 MBTU (10^5 kBTU)	
				0x863d	1 MBTU (10^6 kBTU)	
	Value	4	4	INT4	(Energy reading pos. / neg.)	All except C2, C3
Flow temperature [°C]	DIF	1	1	0x05		All except C2, C3
	VIF	1	1	0x5b		All except C2, C3
	Value	4	4	Float		All except C2, C3

Return temperature [°C]	DIF	1	1	0x05		All except C2, C3
	VIF	1	1	0x5f		All except C2, C3
	Value	4	4	Float		All except C2, C3
Current Date and Time (TimeStamp)	DIF	1	1	0x04		All
	VIF	1	1	0x6d		All
	Value	4	4	INT4	MBus typ F format	All
Fabrication number	DIF	1	1	0x0c		All
	VIF	1	1	0x78		All
	VALUE	4	4	BCD8		All
	Sum	**45**	**46**		incl. Funk Header	
SET 7:						
Main Energy	DIF	1	1	0x04		All except C2, C3
	VIF	1	2		Depends on Unit:	All except C2, C3
				0x03	0.001 kWh (10^0 Wh)	
				0x04	0.01 kWh (10^1 Wh)	
				0x05	0.1 kWh (10^2 Wh)	
				0x06	0.001MWh / 1 kWh (10^3 Wh)	
				0x07	0.01 MWh (10^4 Wh)	
				0xfb00	0.1 MWh (10^{-1} MWh)	
				0xfb01	1 MWh (10^0 MWh)	
				0x0b	0.001 MJ (10^3 J)	
				0x0c	0.01 MJ (10^4 J)	
				0x0d	0.1 MJ (10^5 J)	
				0x0e	0.001 GJ / 1 MJ (10^6 J)	
				0x0f	0.01 GJ (10^7 J)	
				0xfb08	0.1 GJ (10^{-1} GJ)	
				0xfb09	1 GJ (10^0 GJ)	
				0x803d	0.001 kBTU (10^{-3} kBTU)	
				0x813d	0.01 kBTU(10^{-2} kBTU)	
				0x823d	0.1 kBTU(10^{-1} kBTU)	
				0x833d	0.001 MBTU / 1 kBTU (10^0 kBTU)	
				0x843d	0.01 MBTU (10^1 kBTU)	
				0x853d	0.1 MBTU (10^5 kBTU)	
				0x863d	1 MBTU (10^6 kBTU)	
	Value	4	4	INT4	(Energy reading pos. / neg.)	All except C2, C3
Main Volume	DIF	1	1	0x04		All except C1
	VIF	1	2		Depends on Unit:	All except C1
				0x13	0.001 m3 (10^{-3} m^3)	
				0x14	0.01 m3 (10^{-2} m^3)	
				0x15	0.1 m3 (10^{-1} m^3)	
				0x16	1 m3 (10^0 m^3)	
				0x903d	0.001 USGAL (10^{-3} USGAL)	
				0x913d	0.01 USGAL (10^{-2} USGAL)	
				0x923d	0.1 USGAL (10^{-1} USGAL)	
				0x933d	1 USGAL (10^0 USGAL)	
	Value	4	4	INT4		All except C1

Power [W]	DIF	1	1	0x05		All except C2, C3
	VIF	1	1	0x2b		All except C2, C3
	Value	4	4	Float		All except C2, C3
Flow [l/h]	DIF	1	1	0x05		All except C1
	VIF	1	1	0x3b		All except C1
	Value	4	4	Float		All except C1
Flow temperature [°C]	DIF	1	1	0x05		All except C2, C3
	VIF	1	1	0x5b		All except C2, C3
	Value	4	4	Float		All except C2, C3
Return temperature [°C]	DIF	1	1	0x05		All except C2, C3
	VIF	1	1	0x5f		All except C2, C3
	Value	4	4	Float		All except C2, C3
Current Date and Time (Timestamp)	DIF	1	1	0x04		All
	VIF	1	1	0x6d		All
	Value	4	4	INT4	MBus typ F format	All
Fabrication number	DIF	1	1	0x0c		All
	VIF	1	1	0x78		All
	VALUE	4	4	BCD8		All
	Total sum	**63**	**65**		incl. Funk Header	

Description of data set 8:

The SET8 is only available with CALEC STIII FW version > 3.1.09

		Minimal	**Maximal**	**Value**	**Remark**	**Include in type**
		Bytes	**Bytes**			
Message header (always transmitted during transmission)	L-Field	1	1	LEN	Number of following bytes	All
	C-Field	1	1	0x44	Specification of the message form	All
					(Fix 0x44) = SEND/NO REPLY	
	M-Field	2	2	0x25b4	Manufacturer	All
				(IMT)		
	Serial Number	4	4	SNUM	Serial/Fabrication number of the device	All
	Version	1	1	DEV	Device type (from Calculator)	All
	Medium	1	1	MED	Device type	
					0x04 = Return (Warm water)	All except C2, C3
					0x0C = Flow	Not used
					0x07 = Water	C2, C3
	CI-Field	1	1	0x2A	Manufacturer specific = New standard	All

	Status	1	1	STAT	Bit 0-2 = not used Bit 3 = permanent error Bit 4 = temporary error Bit 5-7 = not used (Status according to EN13757)	All
	Sum	**12**	**12**			
SET 8:						
Main Energy	DIF	1	1	0x04		All except C2, C3
	VIF	1	2		Depends on Unit:	All except C2, C3
				0x03	0.001 kWh (100 Wh)	
				0x04	0.01 kWh (101 Wh)	
				0x05	0.1 kWh (102 Wh)	
				0x06	0.001MWh / 1 kWh (103 Wh)	
				0x07	0.01 MWh (104 Wh)	
				0xfb00	0.1 MWh (10-1 MWh)	
				0xfb01	1 MWh (100 MWh)	
				0x0b	0.001 MJ (103 J)	
				0x0c	0.01 MJ (104 J)	
				0x0d	0.1 MJ (105 J)	
				0x0e	0.001 GJ / 1 MJ (106 J)	
				0x0f	0.01 GJ (107 J)	
				0xfb08	0.1 GJ (10-1 GJ)	
				0xfb09	1 GJ (100 GJ)	
				0x803d	0.001 kBTU (10-3 kBTU)	
				0x813d	0.01 kBTU(10-2 kBTU)	
				0x823d	0.1 kBTU(10-1 kBTU)	
				0x833d	0.001 MBTU / 1 kBTU (100 kBTU)	
				0x843d	0.01 MBTU (101 kBTU)	
				0x853d	0.1 MBTU (105 kBTU)	
				0x863d	1 MBTU (106 kBTU)	
	Value	4	4	INT4	(Energy reading pos. / neg.)	All except C2, C3
Main Volume	DIF	1	1	0x04		All except C1
	VIF	1	2		Depends on Unit:	All except C1
				0x13	0.001 m3 (10-3 m3)	
				0x14	0.01 m3 (10-2 m3)	
				0x15	0.1 m3 (10-1 m3)	
				0x16	1 m3 (100 m3)	
				0x903d	0.001 USGAL (10-3 USGAL)	
				0x913d	0.01 USGAL (10-2 USGAL)	
				0x923d	0.1 USGAL (10-1 USGAL)	
				0x933d	1 USGAL (100 USGAL)	
	Value	4	4	INT4		All except C1
Power [W]	DIF	1	1	0x05		All except C2, C3
	VIF	1	1	0x2b		All except C2, C3
	Value	4	4	Float		All except C2, C3
Flow [l/h]	DIF	1	1	0x05		All except C1

	VIF	1	1	0x3b		All except C1
	Value	4	4	Float		All except C1
Flow temperature [°C]	DIF	1	1	0x05		All except C2, C3
	VIF	1	1	0x5b		All except C2, C3
	Value	4	4	Float		All except C2, C3
Return temperature [°C]	DIF	1	1	0x05		All except C2, C3
	VIF	1	1	0x5f		All except C2, C3
	Value	4	4	Float		All except C2, C3
	Sum	**48**	**50**		incl. Funk Header	

Example of message:

32 44 b4 05 78 56 34 12 c0 04 7a 23 04 00 00 04 06 01 00 00 00 05 3b 00 50 9a 44 05 5b 00 00 5c 42 05 5f 00 00 0c 42 04 6d 00 21 21 21 0c 78 78 56 34 12

4. Compact mode Variant

For data length limitation reasons, there is a variant which ensures that only rarely a structure message (Format Frame) is sent and regularly the data message (Compact Frame).

The Compact frame contain all relevant data of the measurement. This frame is sent regularly depending on the configuration of the CALEC.

The Format frame contain the description of the data frame (mainly VIF/DIF). Compact frame is sent every 24h.

Example of the standard frame:

Set 2 – Standard calculator function

Standard frame:

3244B4259999999C0047A43000000040 31E09000005 3B26B19B44055B249B4C42055FB8A5CB4104 6D2C28F8270C7899999999

Data interpretation

L-Field: Length of telegram without L-Field (0x32 = 50bytes)
C-Field: Specification of the message form (Fix 0x44 = SEND/NO REPLY)
M-Field: Manufacturer (Fix 0x25B4 = IMT / bytes are reversed)
Sec. Addr. Field: Fabrication number (0x99999999 = 99999999 / bytes are reversed)
Version: Device function (0xC0 = Standard)
Medium: Device type (0x04 = Return/Warm water)
CI-Field: (Fix 0x7A = Short Header)
Access-Counter: Access counter, increment per readout (0x43 = 67)
Status: (0x00 = No permanent or temporary error)
Config-Field: not used (0x0000)

Main Energy record

DIF 1: Datatype (Fix 0x04 = 32Bit Integer)
VIF 1: Unit and type (0x03 = 0.001kWh | Energy)
Main Energy: (0x0000091E = 2334 / bytes are reversed)

Flow record

DIF 2: Datatype (Fix 0x05 = 32Bit float)
VIF 2: Unit and type (Fix 0x3B = l/h | Flow)
Flow: (0x449BB126 = 1245.53589 / bytes are reversed)

Flow temperature record

DIF 3: Datatype (Fix 0x05 = 32Bit float)
VIF 3: Unit and type (Fix 0x5B = °C | flow temperature)
Flow temperature: (0x424C9B24 = 51.1515045 / bytes are reversed)

Return temperature record

DIF 4: Datatype (Fix 0x05 = 32Bit float)
VIF 4: Unit and type (Fix 0x5F = °C | return temperature)
Return temperature: (0x41CBA5B8 = 25.4559174 / bytes are reversed)

Current Date and Time record

DIF 5: Datatype (Fix 0x04 = 32Bit Integer)
VIF 5: Unit and type (Fix 0x6D = MBUS typ F | Timestamp)
Time and Date: (0x2C28F827 = 24.07.2023 08:44)

Fabrication number record

DIF 6: Datatype (Fix 0x0C = 8 digit BCD)
VIF 6: Unit and type (Fix 0x78 = fabrication number)
Fabrication number: (0x99999999 = 99999999 / bytes are reversed)

Format frame:

1D44B4259999999 9C0046A4800000000E4101040305 3B055B055F046D0C78

L-Field: Length of telegram without L-Field (0x1D = 29bytes)
C-Field: Specification of the message form (Fix 0x44 = SEND/NO REPLY)
M-Field: Manufacturer (Fix 0x25B4 = IMT / bytes are reversed)
Sec. Addr. Field: Fabrication number (0x99999999 = 99999999 / bytes are reversed)
Version: Device function (0xC0 = Standard)
Medium: Device type (0x04 = Return/Warm water)
CI-Field: (Fix 0x6A = Format frame / Fix 0x1A for SET 8 = manufacturer specific)
Access-Counter: Access counter, increment per readout (0x48 = 72). Not transmitted in SET 8
Status: (0x00 = No permanent or temporary error)
Config-Field: not used (0x0000). Not transmitted in SET 8
L-Field: Length for the format data. From "Format CRC" to the end of telegram (0x0E = 14 bytes)
Format CRC: CRC of all format data / all data from first DIF to the end of telegram (0x4101)
Main Energy record
DIF 1: Datatype (Fix 0x04 = 32Bit Integer)
VIF 1: Unit and type (0x03 = 0.001kWh | Energy)
Flow record
DIF 2: Datatype (Fix 0x05 = 32Bit float)
VIF 2: Unit and type (Fix 0x3B = l/h | Flow)
Flow temperature record
DIF 3: Datatype (Fix 0x05 = 32Bit float)
VIF 3: Unit and type (Fix 0x5B = °C | flow temperature)
Return temperature record
DIF 4: Datatype (Fix 0x05 = 32Bit float)
VIF 4: Unit and type (Fix 0x5F = °C | return temperature)
Current Date and Time record
DIF 5: Datatype (Fix 0x04 = 32Bit Integer)
VIF 5: Unit and type (Fix 0x6D = MBUS typ F | Timestamp)
Fabrication number record
DIF 6: Datatype (Fix 0x0C = 8 digit BCD)
VIF 6: Unit and type (Fix 0x78 = fabrication number)

Compact frame:

2A44B4259999999 9C0047B52000000041012F8E6F1000001F0F9C44849C4C42F8A2CB412F28F827999 99999

L-Field: Length of telegram without L-Field (0x2A = 42bytes)
C-Field: Specification of the message form (Fix 0x44 = SEND/NO REPLY)
M-Field: Manufacturer (Fix 0x25B4 = IMT / bytes are reversed)
Sec. Addr. Field: Fabrication number (0x99999999 = 99999999 / bytes are reversed)
Version: Device function (0xC0 = Standard)
Medium: Device type (0x04 = Return/Warm water)
CI-Field: (Fix 0x7B = compact frame / Fix 0x2B for SET 8 = manufacturer specific)
Access-Counter: Access counter, increment per readout (0x48 = 72). Not transmitted in SET 8
Status: (0x00 = No permanent or temporary error)
Config-Field: not used (0x0000). Not transmitted in SET 8
Format CRC: CRC of format data from Format frame (0x4101)
FullFrame CRC: CRC of all record data / all data from first record to the end of telegram (0x2F8E)
Main Energy record
Value record 1: Main - Energy 32Bit Integer (0x0000106F = 4207 / bytes are reversed)
Flow record
Value record 2: Flow - 32Bit float (0x449C0F1F = 1248.4725 / bytes are reversed)
Flow temperature record
Value record 3: Flow - temperature 32Bit float (0x424C9C84 = 51.15285 / bytes are reversed)
Return temperature record

Value record 4: Return - temperature 32Bit float (0x41CBA2F8 = 25.45457 / bytes are reversed)
Current Date and Time record
Value record 5: Current Date and Time - 32Bit Integer (0x2F28F827 = 24.07.23 08:47)
Fabrication number record
Value record 6: Fabrication number - 8 digit BCD (0x99999999 = 99999999 / bytes are reversed)

5. Commissioning the CALEC® ST III with the LoRa interface

After installing the LoRa print, the antenna socket, the antenna feed cable and the antenna itself, the power can be supplied. The external antenna can either be a rigid stub antenna or a detachable magnetic base antenna, which is supplied with a 3 meters antenna extension cable as standard. As soon as the CALEC ST III is supplied with power, the LoRa communication module starts to transmit with the factory settings stored.

6. Parameterizing the LoRa interface of the CALEC® ST III

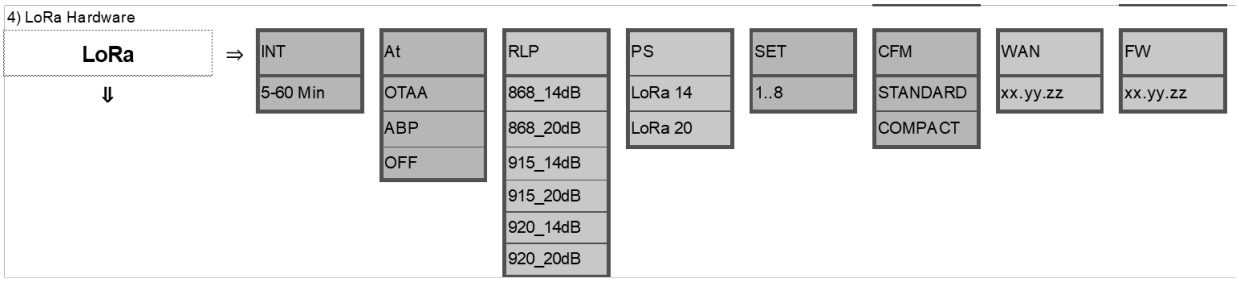
If you want to change the factory settings, the following parameters can be edited.

LoRa Parameter	**Range of values**	**Displayed on Device**	**Display Text**	
Transmission interval	1min – 60min	15 min	Yes	InT
DevAddr (Device Address)	0000 0000 – FFFF FFFF	Individual at factory	No	-
NwkSKey (Network Session Key)	0000 0000 0000 0000 0000 0000 0000 0000 – FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF	Individual at factory	No	-
DevEUI (EUI)	0000 0000 0000 0000 – FFFF FFFF FFFF FFFF	Individual at factory	No	-
AppEUI	0000 0000 0000 0000 – FFFF FFFF FFFF FFFF	Individual at factory	No	-
AppKey (Application Key)	0000 0000 0000 0000 0000 0000 0000 0000 – FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF	Individual at factory	No	-
AppSKey (Application Session Key)	0000 0000 0000 0000 0000 0000 0000 0000 – FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF	Individual at factory	No	-
Activation mode (OTAA, ABP)	OTAA (0x00), ABP (0x01)	OTAA	Yes	AT
Regional LoRa Parameter set	EU868_14dBm (0x00), EU868_20dBm (0x01), EU915_14dBm (0x00), EU915_20dBm (0x01), EU920_14dBm (0x00), EU920_20dBm (0x01)	EU868_14dBm	Yes	RLP
Radio standard	List : LoRa_14, LoRa_20	LoRa_14	Yes	PS
Frame format	List : Standard or Compact	Standard	Yes	CFM
Data package Set number	1 – 8	1	Yes	SET

FW-Version Calculator	x.yy.zz (numeric)	-	Yes	FW
LoRaWAN-Version LoRa Module	x.yy.zz (numeric)	-	Yes	WAN
FW-Version LoRa Module	x.yy.zz (numeric)	-	Yes	FW

There are different possibilities to modify the parameters for LoRa communication:

- Directly on the CALEC using the keyboard itself in order to go in the different menus and change parameters according to your need.



- Editing the AES key directly on the device is not possible due to the considerable character length and the complexity. The only way is to use our ParamApp Android Tool.

- Use our Android ParamApp Tool for Smart Phone available directly on GooglePlay.

7. Troubleshooting

Error / malfunction	Possible cause	Solution
CALEC® ST III does not communicate with LoRa-Bus radio module	Missing antenna	Check whether an antenna is connected to the device. (Stub antenna or remote magnetic base antenna). The arithmetic unit can be destroyed if the device is supplied with power or if no antenna is connected.