

ELMAR

ELectroMAGnetic Recorder

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- ... provides seismic and magnetotelluric instruments and sensors for projects of GFZ groups, universities and other research facilities ...
- MT component
 - 30 long period instruments (fluxgate magnetometers).
 - 50 broad-band instruments (induction coils).
- S.P.A.M Mk4 data loggers were introduced in 2011/12 and need to be replaced.

ELMAR

- Same size (and look) as S.P.A.M Mk4
- No external sensor-boxes.
- Data storage on SD card.
- 5 channels.
- Frequency range: DC – 256 kHz.
- 24-Bit ADC (oversampling, automatic gain-ranging).
- GPS synchronization (int/ext).
- Real-time time series, digital filtering and MT processing.
- Reduced power consumption.



Analogue section (keep it simple)

- Amplifiers (differential) with high impedance inputs ($G\Omega$ range)
- Adjustable gains (2 stages)
 - E-fields: 5 - 400
 - B-fields: 0.1 - 20
- DC offset (self-potential) compensation (optional)
- Integrated signal generator
 - Self-test system components
 - Measure contact-resistance of electrodes
 - Send test signal to induction coils

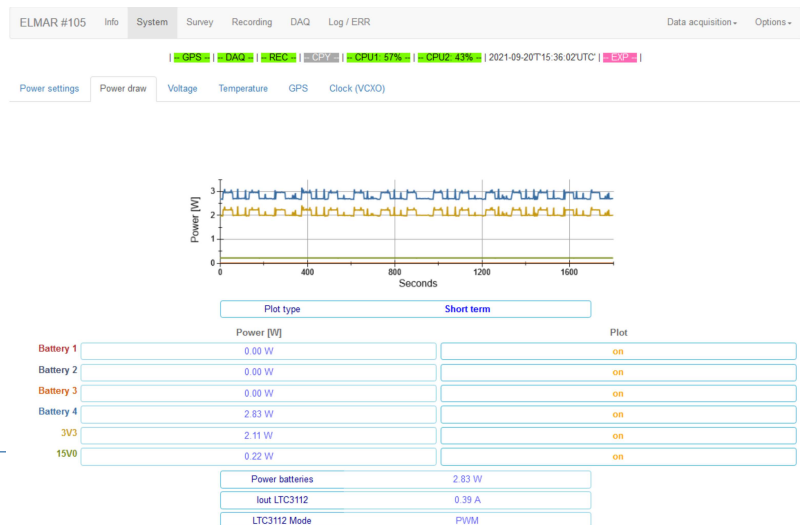
Power supply

- 4 wide-range DC inputs (9 V – 36 V)
 - External batteries
 - Power banks under lid (USB-C PD standard)
 - Hot swapping of batteries supported
- Power over Ethernet (PoE+)
 - long cables
 - permanent installations
- Internal backup capacitor
 - System shutdown on power failure
- Internal monitoring of power consumption and voltages
 - Low-voltage shutdown

Power consumption

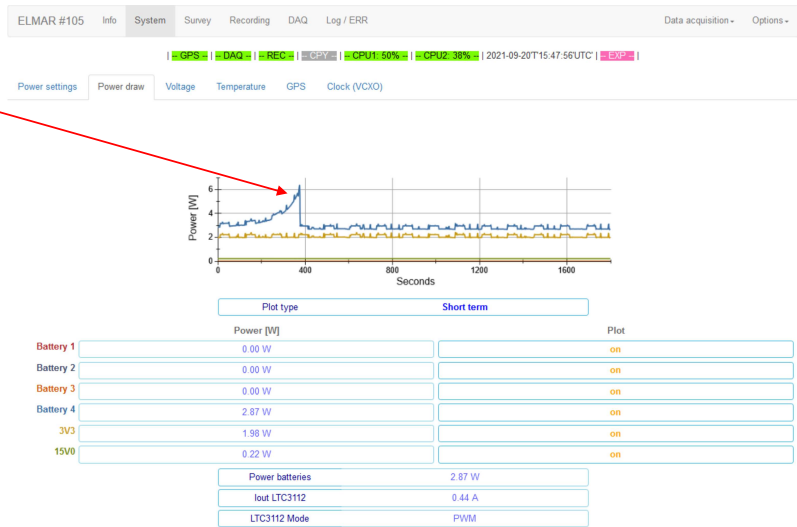
Typical: 3 W

- All channels on
- GPS on
- Signal generator on
- DAQ 64kHz
- Copying data int. SD→ ext. SD
- 15V on (no sensors connected)



Power consumption

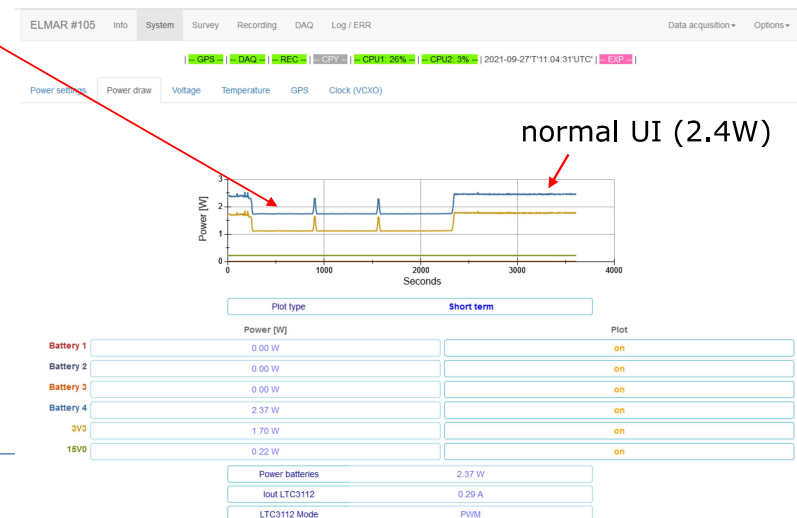
Charging the power cap...



Power consumption

Power save (LMT) mode (1.7W)

- All channels on
- GPS on
- Signal generator on
- **DAQ 4kHz**
- Recording enabled
- 15V on (no sensors connected)



User Interface, computer module

- Web-based user interface
 - any web-browser
 - any operating system
- Main computer: NXP i.MX7
 - Gigabit Ethernet connection
 - Operating system: Linux (on flash memory)
 - Debugging console (UART)
- File access (SD cards): Samba, ssh, ...
- System status messages on e-ink display
- LoRa (optional)

Recording and Scheduler

ELMAR #105 Info System Survey **Recording** DAQ Log / ERR Data acquisition Options

GPS DAQ REC CPU1: 55% CPU2: 41% 2021-09-20T15:52:59UTC

Overview [VH] [H] [M] [L] [VL] Files

	Band layout / band sample frequency	Schedule	Bytes written / Files written
VH	[HF OPEN 256000 Hz] / 256000.000000 Hz	disabled	0 / 0
H	[HF OPEN 64000 Hz] / 64000.000000 Hz	[1 min / 2 min]	4410433536 / 285
M	[HF OPEN 16000 Hz] / 16000.000000 Hz	disabled	0 / 0
L	[LF SHLD 4000 Hz] / 4000.000000 Hz	disabled	0 / 0
VL	[LF SHLD 4000 Hz] / 500.000000 Hz	disabled	0 / 0

Gbytes per day	55.296
Days left SD (int)	4.0
Days left SD (ext)	4.0

ELMAR #95 Info System Survey Recording DAQ Log / ERR Data acquisition - Options -

GPS DAQ REC COPY CPU1: 20% CPU2: 1% 2021-09-20T15:58:01UTC EXP ERR

Overview [VH] [H] [M] [L] [VL] Files

State	on
Band layout	[HF OPEN 64000 Hz]
ADC sample frequency	64000.000000 Hz
Band Sample frequency	64000.000000 Hz
Lowpass frequency	25600.000000 Hz
Chopper	disabled
Shields	disabled
For	10 min
Every	2 h
Start	00:00
Stop	00:00

« September 2021 » Selected days

Mon	Tue	Wed	Thu	Fri	Sat	Sun
30	31	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	1	2	3
4	5	6	7	8	9	10

Clear

System status messages on e-ink display



Time series example (test signal)



Real data examples ...

- Starting in 2022...
- General availability: After we tried them in the field.

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