The mono-stand system for detection of paper labels and hard tags

IRIDIUM mono 2k 8.2MHz

Technical documentation, installation instructions

IR 1040 06 V4

IRIDIUM mono 2k Alfa

Contents

2. Description

IRIDIUM Mono 2k (referred to as "IRD system" henceforth) is designed to protect merchandise in shops. It operates in the frequency range 7.9 – 8.5 MHz. It detects all kinds of tags of various manufacturers ("hard", "soft" and paper) which are designed for 8 MHz radio frequency systems. The system consists of one mechanical frame (stand), an electronics board and a power adapter. The IRD system can be installed individually or in groups. For individual installation (up to six mono systems), no cable synchronization is required. For multiple installed systems, synchronization is done with a two-core cable. IRD systems can detect tags synchronously with a 50 (60) Hz network frequency or independently from the network frequency at a rate of 30 to 100 times per second. Sensitivity and system synchronization can be set manually or automatically.

We install the IRD system in an area that all customers must pass when leaving the protected area – so-called "check out" installation. If necessary, the system can also be placed in the entrance area – "check-in" installation. The IRD system installed in this way alerts customers who may accidentally bring protective tags to the shop area.

The location of the installation and the distance between the detection stands for the multiple installation is determined with respect to tags with the smallest detection distance. We also take into account the nature of the environment at the installation site, the proximity of metal frames, power cables, halogen lighting, information technology, automatic doors and other near-frequency radio systems installed.

Tag detection (henceforth referred to as "alarm") is signaled by sound and light. When the tag has been in the detection area for more than about 15 to 20 seconds, the beep sound is canceled and the light changes to two short flashes repeating after about one second. This signalization of a tag detection within the range of the stand takes about 20 seconds. After this time, signaling is aborted.

The IRD system signals some of the fault states of the electronics using light and sound.

3. Technical documentation

Type designation	**IR 1040 06 V1**
Commercial designation	IRIDIUM ALPHA 8.2 mono 2k
Producer	IRIDIUM LTD, spol. s r.o. Slovakia
Working frequency range	7.9 MHz – 8.5 MHz
Channel range	100 kHz
Max. RF power EIRP	< 9 dBuA/m in distance of 10m
Output voltage from AC / AC adapter	15 to 18 V AC /0,6A 50Hz or 60Hz
Technical standards	STN EN 300 330-1:V1.3.2
Dimensions	height 166.5 cm, width 38.3 cm, depth 9.6cm
Weight	4.75kg (without network adapter)
Detection distance	depending on the type of tags, (size and type of tag), up to 160 cm on each side
Alarm signalization	optical (LED diodes), acoustic (piezo-siren)

4. Description of the electronics board 1040 06A

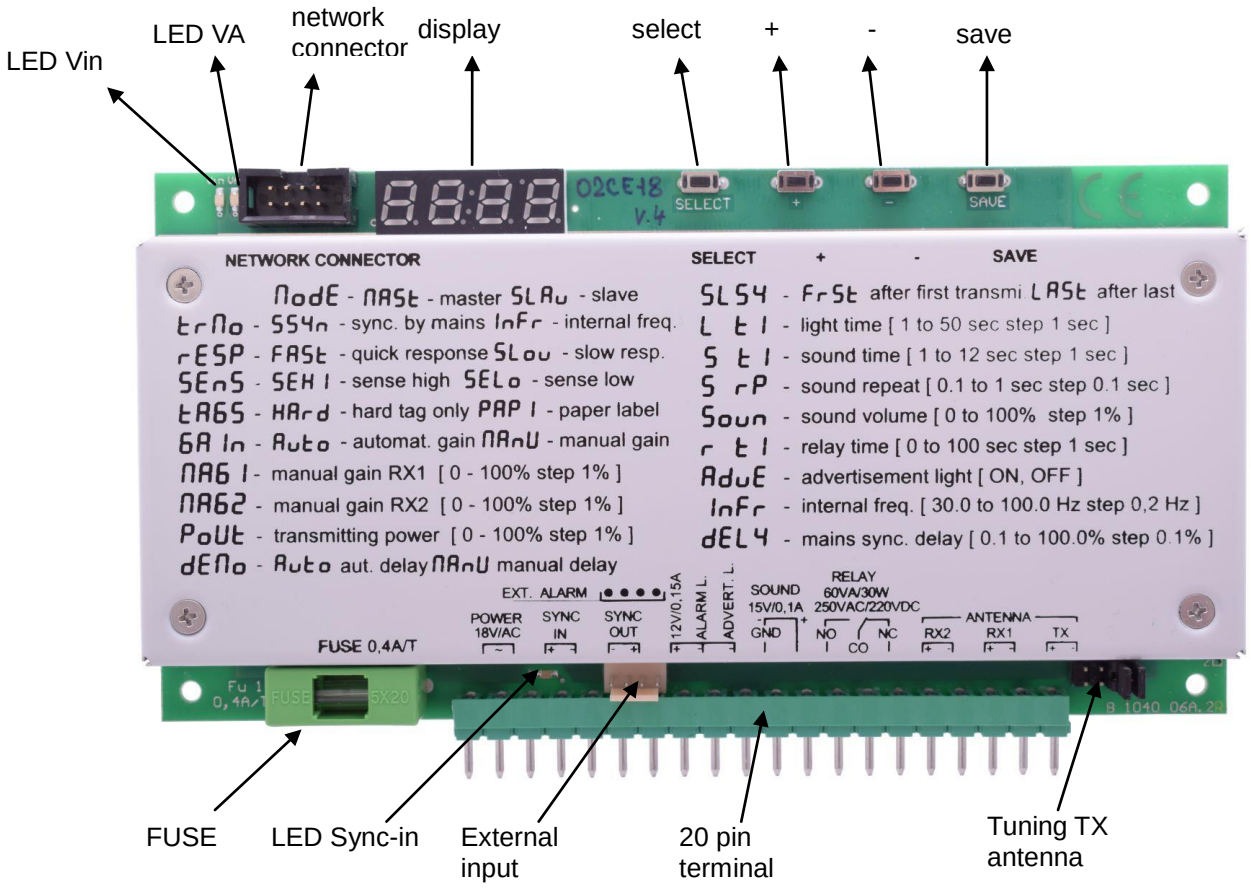


Fig. 1: Electronics board 1040 06A

Via a transmitting antenna (installed in the frame) the electronics transmits a high-frequency el. signal in intervals from minimum to maximum frequency (min. 7.90 MHz to max. 8.50 MHz) and through reception antennas it received and evaluates radio frequency signals, thereby detecting tags in the frame area. The presence of a tag is signaled optically, by sound or electrically by the signal issued from the electronics board connector.

4.1. Description of terminal pins

POWER 18V/AC	supply voltage input from power adapter
SYNC. IN	terminal for connecting of synchronization input in case of MASTER–SLAVE installations
SYNC. OUT	terminal for connecting of synchronization output in case of MASTER–SLAVE installations
12V/0,15A	plus power pole for light alarm signalization and advertisement light
ALARM L.	minus power pole for light alarm signalization (LED)
ADVERT. L.	minus power pole for advertisement light (LED)
SOUND	connecting of acoustic alarm signalization (piezo-siren)
RELAY	relay switching contacts for remote alarm indication
RX2 ANTENNA	second receiving antenna
RX1 ANTENNA	first receiving antenna
TX ANTENNA	transmitting antenna
EXT. ALARM	external alarm
NETWORK CONNECTOR	remote system monitoring and control

4.2. Description of LED signaling buttons, the display and ext. alarm connector

Four-digit display	multi-function display unit – see description below
Vin	presence of a rectified supply voltage
VA	presence of a 12V supply voltage
SYNC. IN	presence of a signal on the SYNC IN terminals

You can set up and control the electronics by using four buttons and a four-digit LED display. Display works in two modes: parameter input mode and measured data control mode. The data control mode is set as default. To change the control mode to the parameter input mode, press SELECT. The input mode is always exited by pressing the SAVE button.

When the electronics board is connected to the supply voltage, first the initial tests are displayed, after that the display enters the data control mode and starts displaying the first measured data (input signal level in channel 1).

The two green LEDs located to the left of the display indicate the presence of voltage for the analog and digital parts of the electronics board. The NETWORK CONNECTOR connector is used to connect remote system monitoring and control.

Buttons have the following uses:

SELECT is used to change from control mode to input mode and for navigation in the Menu, i.e. to display the parameter that one wants to set.

+ is used to change the value of the parameter that is being set or to change the parameter that is controlled.

- is used to change the value of the parameter that is being set or to change the parameter that is controlled.

SAVE serves to remember and set a new parameter value, as well as a means to enter the data control mode. After pressing the button in the data control mode (if the display is on), the following values appear gradually:

In 1 interval in which the antenna broadcasts (example is the 1. interval)
Fr 3 how many intervals are free (example shows 3 free intervals)
Sr 4 software version of the program
IdEn identifier of the electronics board
0310identifier of the Mono 2k board
0156production plate number

The software version, identifier, and serial number are always displayed. Interval in which the electronics board works and the number of free intervals is shown only in Master (**NodE - NASt**), network synchronization (**trNo - SS4n**), and automatic delay setting mode (**dENo - Auto**).

4.3. Description of measured data control

The control of measured data is the default display mode. In this mode, the serial number of the displayed data is displayed for about a second, then the data value is displayed for about six seconds – the listings are alternated in this way. After about two minutes of inactivity (no button pressed) the display switches to sleep mode (turns off). You can re-display the most recently displayed data by pressing any of the **+**, **-**, **SAVE** or **SELECT** buttons. Use the **+**, **-** buttons to display the individual data as follows:

1. input signal level – channel 1, in % (default setting)
2. input signal level – channel 2, in %
3. average background signal level – channel 1, in %
4. average background signal level – channel 2, in %
5. level of permanent resonance in the input signal – channel 1, in %
6. level of permanent resonance in the input signal – channel 2, in %
7. automatically set increments (in %) in the **GAIn – Auto** mode – channel 1
8. automatically set increments (in %) in the **GAIn – Auto** mode – channel 2
9. portion of the input signal (in %) with a value sufficient for alarm – channel 1
10. portion of the input signal (in %) with a value sufficient for alarm – channel 2
11. total number of alarm level exceedings in channel 1, alternating with the value for channel 2 (the value for channel 2 includes a decimal mark at the end for the purpose of distinguishing between the channels). The measured data can be reset by switching the electronics off and on again or by remote control through the internet.

12. total number of alarms. The number can be reset by switching the electronics off and on again or by remote control through the internet.

4.4. Setting the parameters

The following parameters can be set on the electronics:

1.	**NodE**	**Mode**	**(Mode of operation)**
2.	**trNo**	**Transmitting mode**	**(Transmitting mode)**
3.	**rESP**	**Response**	**(Response)**
4.	**SEnS**	**Sensitivity**	**(Sensitivity)**
5.	**tAGS**	**Tags**	**(Tags)**
6.	**GAIn**	**Gain**	**(Gain of the channels)**
7.	**NAG1**	**Manual Gain 1**	**(Manual gain value - channel 1)**
4.	**NAG2**	**Manual Gain 2**	**(Manual gain value - channel - kanál 2)**
5.	**PoUt**	**Power Out**	**(Transmitting power)**
10.	**dENo**	**Delay Mode**	**(Mode of delay setting)**
11.	**SLS4**	**Slave Sync**	**(Slave mode synchronization mode)**
12.	**L t1**	**Light time**	**(Alarm light time)**
13.	**S t1**	**Sound time**	**(Alarm sound time)**
14.	**S rP**	**Sound repeat**	**(Alarm sound frequency)**
15.	**S uL**	**Sound volume**	**(Alarm sound volume)**
16.	**r t1**	**Relay time**	**(Alarm time on RELAY terminals)**
17.	**AduE**	**Advertisement**	**(Advertisement light)**
18.	**InFr**	**Internal Frequency**	**(Transmission frequency)**
19.	**dEL4**	**Delay value**	**(Transmission delay value)**

Setting the Mode parameter – NodE

Parameter Mode is used to set the mode of operation of the IRD system, it can work in two different modes.

NASt Master mode - in this mode, the IRD system can work independently or as a control unit for systems operating in SLAVE mode.

SLAu Slave mode - in this mode, the IRD system can not work independently but must be connected to the MASTER system or the previous SLAVE system that provides the electronic board the impulse for initiating transmission.

1. Press **SELECT** until **NodE** is displayed
2. Using the **+**,**-** buttons, set the desired mode of operation.
3. Press the **SAVE** button, for approx. 2 seconds the **rECo** (record) message is displayed and the mode is memorized and set. If the newly set mode is the same as the one previously set, **UnCH** (unchanged) is displayed and after about 1 second the most recently displayed data will be displayed in the control display mode.

Setting the Transmitting mode parameter – trNo

The **Transmitting Mode** parameter is used to set the IRD transmission method; two different modes of transmission are possible.

SS4n Network synchronization - the IRD system's transmission is synchronized with the network frequency – the system transmits 50 (60) times per second, the transmission delay is determined by the parameters **Delay Mode** (**dENo**) and **Delay value** (**dEL4**).

InFr Internal frequency – in this mode the transmission frequency is determined by the parameter **Internal Frequency** (**InFr**) and can be between 30 to 100 times per second. In this case, the IRD system transmits independently of the network frequency.

1. Press **SELECT** until **trNo** is displayed.
2. Using the **+**,**-** buttons, set the desired mode, **SS4n** or **InFr**.
3. Press the **SAVE** button, for approx. 2 seconds the **rECo** (record) message is displayed and the mode of transmission is set. If the newly set mode is the same as the one previously set, **UnCH** (unchanged) is displayed and after about 1 second the most recently displayed data will be displayed in the control display mode.

Setting the Response parameter – rESP

Parameter Response serves to set the alarm rate. It is possible to set two speeds of evaluation: **FASt** – fast, in which case the IRD system evaluates the alarm more quickly but at a higher level of interference and the system is more susceptible to false alarms. The slower **SLoU** evaluation method is slower but less prone to interference and evaluation of false alarms.

1. Press SELECT until **trNo** is displayed.
2. Using the **+,-** buttons, set the desired response speed, **FASt** or **SloU**.
3. Press the SAVE button, for approx. 2 seconds the rECo (record) message is displayed and the response speed is set. If the newly set mode is the same as the one previously set, **UnCH** (unchanged) is displayed and after about 1 second the most recently displayed data will be displayed in the control display mode.

Setting the Sensitivity parameter – SEnS

The Sensitivity parameter sets the sensitivity of the alarm evaluation. It is possible to set two sensitivity sensitivity levels: **SEHI** – high sensitivity, in which case the IRD system detects the label over a longer distance with little interference, but the detection distance may be shorted at high interference. The second sensitivity level of **SELo** – small, which is more advantageous in case of high interference.

1. Press **SELECT** until **SenS** is displayed.
2. Using the **+,-** buttons, set the desired sensitivity, **SEHI** or **SELo**.
3. Press the **SAVE** button, for approx. 2 seconds the **rECo** (record) message is displayed and the sensitivity is set. If the newly set mode is the same as the one previously set, **UnCH** (unchanged) is displayed and after about 1 second the most recently displayed data will be displayed in the control display mode.

Setting the Tags parameter – tAGS

Parameter **Tags** is used to set the tags used for the installation. For installation with only hard tags (non-deactivatable), it is necessary to set **HArd**. If deactivatable tags are used, the parameter **PAPI** should be set. With this setting active, if a tag is brought close to the stand, the IRD system reduces the transmission power so that the label is not deactivated.

1. Press **SELECT** until **tAGS** is displayed.
2. Using the **+,-** buttons, set the desired sensitivity, **HArd** or **PAPI**.
3. Press the **SAVE** button, for approx. 2 seconds the **rECo** (record) message is displayed and the Tags setting is set. If the newly set mode is the same as the one previously set, **UnCH** (unchanged) is displayed and after about 1 second the most recently displayed data will be displayed in the control display mode.

Setting the Gain parameter – GAIn

The Gain parameter serves to set the mode of signal gain in the receiving channels. It is possible to set two ways of gain: **Auto** – automatic gain setting or **NAnU** – manual setting. We recommend automatic gain, in which case the IRD system sets the optimal gain automatically independently for both channels. If for some reason you a specific setting is needed, for example, if the reception conditions that can cause false alarms change randomly and quickly, you need to set the gain method manually. The system sets the gain for channels 1 and 2 according to the value set in parameters **NAG1**, **NAG2**.

1. Press **SELECT** until **GAIn** is displayed.
2. Using the **+,-** buttons, set the desired sensitivity, **Auto** or **NAnU**.
3. Press the **SAVE** button, for approx. 2 seconds the **rECo** (record) message is displayed and the Gain setting is set. If the newly set mode is the same as the one previously set, **UnCH** (unchanged) is displayed and after about 1 second the most recently displayed data will be displayed in the control display mode.

Setting the Manual Gain 1 parameter – NAG1

The **Manual Gain 1** parameter specifies the gain value for reception channel 1. The value is only active if the **GAIn** – **NAnU** parameter is set. Parameter takes on a value between 0 and 100 %, 0 % representing the minimum gain and 100 % the maximum gain.

1. Press **SELECT** until **NAG1** is displayed.
2. Using the **+,-** buttons, set the desired value between 0 and 100.
3. Press the **SAVE** button, for approx. 2 seconds the **rECo** (record) message is displayed and the Gain setting is set. If the newly set value is the same as the one previously set, **UnCH** (unchanged) is displayed and after about 1 second the most recently displayed data will be displayed in the control display mode.

Setting the Manual Gain 2 parameter – NAG2

The **Manual Gain 2** parameter specifies the gain value for reception channel 2. The value is only active if the **GAIn** – **NAnU** parameter is set. Parameter takes on a value between 0 and 100 %, 0 % representing the minimum gain and 100 % the maximum gain.

1. Press **SELECT** until **NAG2** is displayed.
2. Using the **+,-** buttons, set the desired value between 0 and 100.
3. Press the **SAVE** button, for approx. 2 seconds the **rECo** (record) message is displayed and the Gain setting is set. If the newly set value is the same as the one previously set, **UnCH** (unchanged) is displayed and after about 1 second the most recently displayed data will be displayed in the control display mode.

Setting the Power Out parameter – PoUt

The Power Out parameter specifies the power transmitted by the electronics board to the transmitting antenna. The parameter must be set according to the required detection distance, taking a value from 0 to 100 %, where 0 % corresponds to minimum transmitted power and 100 % to maximum transmitted power.

1. Press **SELECT** until **PoUt** is displayed.
2. Using the **+,-** buttons, set the desired value between 0 and 100.
3. Press the **SAVE** button, for approx. 2 seconds the **rECo** (record) message is displayed and the Power Out setting is set. If the newly set value is the same as the one previously set, **UnCH** (unchanged) is displayed and after about 1 second the most recently displayed data will be displayed in the control display mode.

Setting the Delay Mode parameter – dENo

The Delay Mode parameter specifies the method of transmission delay in network synchronization mode (**trNo** - **SS4n**). The IRD system can set the delay automatically or set the delay specified by the **dEL4** parameter – (transmission delay value).

1. Press **SELECT** until **dENo** is displayed.
2. Using the **+,-** buttons, set the desired method, **Auto** or **NAnu**.
3. Press the **SAVE** button, for approx. 2 seconds the **rECo** (record) message is displayed and the Delay mode setting is set. If the newly set mode is the same as the one previously set, **UnCH** (unchanged) is displayed and after about 1 second the most recently displayed data will be displayed in the control display mode.

Setting the Slave Sync parameter – SLS4

The **Slave Sync** parameter determines at which time the IRD system sends a synchronization pulse (output to the SYNC OUT terminals) to the next IRD system (operating in SLAVE mode) connected with cables with “our” IRD system.

The IRD system transmits power over a certain amount of time. If we wish that an IRD system operateing in SLAVE mode should transmit at the same time interval (as its MASTER), we set the parameter to **FIrS** (first). If we want to make the IRD system (SLAVE) broadcast in a new time interval, it is necessary to set **LASt** (last).

If the MASTER IRD system’s Transmitting mode is set to network synchronization (**trNo** - **SS4n**), up to 11/9 (50/60 Hz network frequency) SLAVE IRD systems synchronized with the MASTER IRD system can work at the same time. This way, they can work together in one group of 12 IRD systems for a 50 Hz network frequency and 10 IRD systems for a 60 Hz network frequency.

If the IRD system (operating in the MASTER mode) is set to Transmitting Mode – Internal Frequency (**trNo** – **InFr**), up to 12 electronics can work in the same time interval regardless of the network frequency.

1. Press **SELECT** until **SLS4** is displayed.
2. Using the **+,-** buttons, set the desired value, **FIrS** or **LASt**.
3. Press the **SAVE** button, for approx. 2 seconds the **rECo** (record) message is displayed and the Slave Sync parameter setting is set. If the newly set value is the same as the one previously set, **UnCH** (unchanged) is displayed and after about 1 second the most recently displayed data will be displayed in the control display mode.

Setting the Light time parameter – L t1

The **Light time** parameter specifies the length of light alarm signalization in seconds.

1. Press **SELECT** until **L t1** is displayed.
2. Using the **+,-** buttons, set the desired value between 1 and 50.
3. Press the **SAVE** button, for approx. 2 seconds the **rECo** (record) message is displayed and the value is set. If the newly set value is the same as the one previously set, **UnCH** (unchanged) is displayed and after about 1 second the most recently displayed data will be displayed in the control display mode.

Setting the Sound time parameter – S t1

The Sound **time** parameter specifies the length of sound alarm signalization in seconds.

1. Press **SELECT** until **S t1** is displayed.
2. Using the **+,-** buttons, set the desired value between 1 and 12.
3. Press the **SAVE** button, for approx. 2 seconds the **rECo** (record) message is displayed and the value is set. If the newly set value is the same as the one previously set, **UnCH** (unchanged) is displayed and after about 1 second the most recently displayed data will be displayed in the control display mode.

Setting the Sound repeat parameter – S rP

The **Sound repeat** parameter specifies the period of sound alarm signalization in seconds.

1. Press **SELECT** until **S rP** is displayed.
2. Using the **+,-** buttons, set the desired value between 1 and 12.
3. Press the **SAVE** button, for approx. 2 seconds the **rECo** (record) message is displayed and the period value is set. If the newly set value is the same as the one previously set, **UnCH** (unchanged) is displayed and after about 1 second the most recently displayed data will be displayed in the control display mode.

Setting the Sound volume parameter – S uL

The **Sound repeat** parameter specifies the volume of sound alarm signalization in %, where 0 corresponds to silence and 100 to maximum volume.

1. Press **SELECT** until **S uL** is displayed.
2. Using the **+,-** buttons, set the desired value between 1 and 12.
3. Press the **SAVE** button, for approx. 2 seconds the **rECo** (record) message is displayed and the volume value is set. If the newly set value is the same as the one previously set, **UnCH** (unchanged) is displayed and after about 1 second the most recently displayed data will be displayed in the control display mode.

Setting the Relay time parameter – r t1

The **Relay Time** parameter specifies the alarm signaling length on the RELAY terminals in seconds.

1. Press **SELECT** until **r t1** is displayed.
2. Using the **+,-** buttons, set the desired value between 0 and 100.
3. Press the **SAVE** button, for approx. 2 seconds the **rECo** (record) message is displayed and the time value is set. If the newly set value is the same as the one previously set, **UnCH** (unchanged) is displayed and after about 1 second the most recently displayed data will be displayed in the control display mode.

Setting the Advertisement parameter – AduE

The **Advertisement** parameter lets you illuminate an ad placed in the IRD system frame when there is no alarm. It can be switched on – **on** or off – **oFF**.

1. Press **SELECT** until **AduE** is displayed.
2. Using the **+,-** buttons, set the desired value **on** or **oFF**.
3. Press the **SAVE** button, for approx. 2 seconds the **rECo** (record) message is displayed and the ad parameter is set. If the newly set value is the same as the one previously set, **UnCH** (unchanged) is displayed and after about 1 second the most recently displayed data will be displayed in the control display mode.

Setting the Internal Frequency parameter – InFr

The **Internal Frequency** parameter sets the frequency with which the IRD system transmits while the **Transmitting Mode** is set to Internal Frequency (**trNo - InFr**). It is possible to set the frequency between 30.0 and 100.0 Hz in 0.2 Hz increments.

1. Press **SELECT** until **InFr** is displayed.
2. Using the **+,-** buttons, set the desired value between 30.0 and 100.0.
3. Press the **SAVE** button, for approx. 2 seconds the **rECo** (record) message is displayed and the frequency value is set. If the newly set value is the same as the one previously set, **UnCH** (unchanged) is displayed and after about 1 second the most recently displayed data will be displayed in the control display mode.

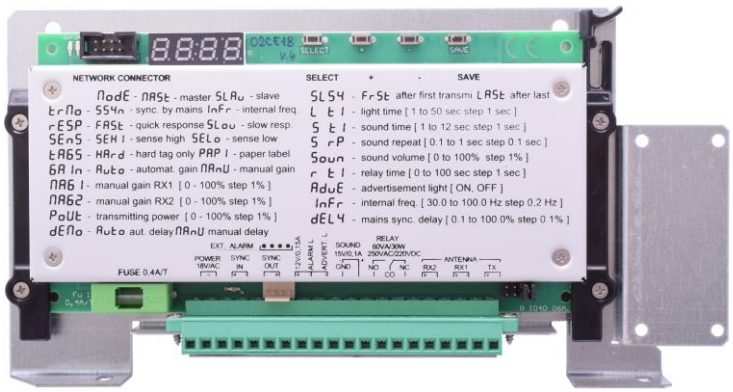
Setting the Delay value parameter – dEL4

Parameter **Delay value** určuje oneskorenie vysielania pri nastavenom parametri Transmitting mode – **trNo** - **SS4n** (vysielanie elektroniky je synchronizované sieťovou frekvenciou). Parameter určuje s akým oneskorením začne elektronika vysielať po prechode sieťového napätia 0 volt. Parameter je možné nastaviť od 0,1 do 100,0%, 0,1% minimálne oneskorenie, 100,0% maximálne oneskorenie.

The **Delay value** parameter determines the transmission delay while the **Transmitting mode** parameter is set to network synchronization – **trNo** - **SS4n**. The parameter determines the delay with which the electronics will begin to transmit after crossing the 0 volt value of the network voltage. Parameter can be set from 0.1 % to 100.0 %, 0.1 % corresponding to minimum delay and 100.0 % to maximum delay.

1. Press **SELECT** until **dEL4** is displayed.
2. Using the **+,-** buttons, set the desired value between 0.1 and 100.0.
3. Press the **SAVE** button, for approx. 2 seconds the **rECo** (record) message is displayed and the delay value is set. If the newly set value is the same as the one previously set, **UnCH** (unchanged) is displayed and after about 1 second the most recently displayed data start being displayed in the control display mode.

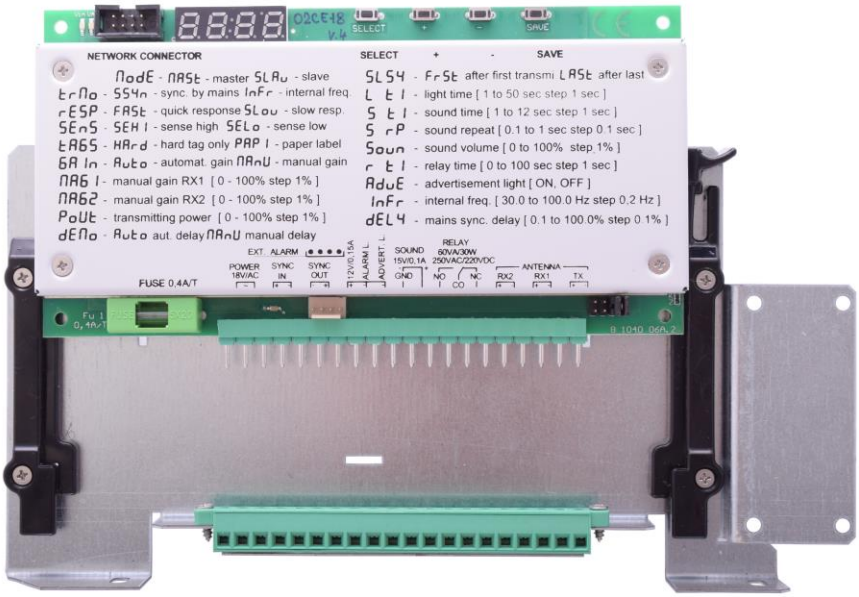
6. Electronic board IRD 1040 06 including the plug-in mechanism



5.1 Plug-in mechanism

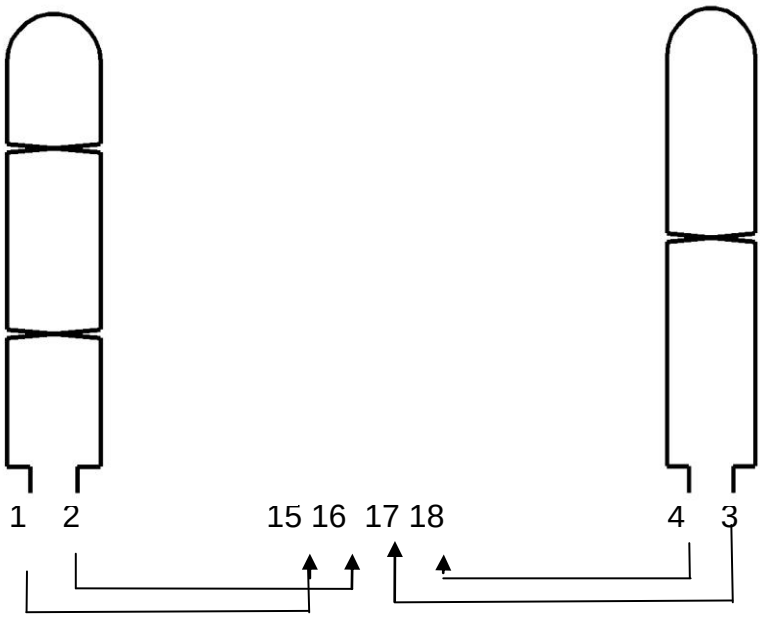
Electronic board is fixed in the plug-in mechanism. This solution enables very simple and easy replacement. Just push the plastic lever to the right, which fixes the position of the electronic board and then push the board up from the 20-pin connector. That's all.

To plug the board back in just simply slide an electronic board back to the 20-pin connector.



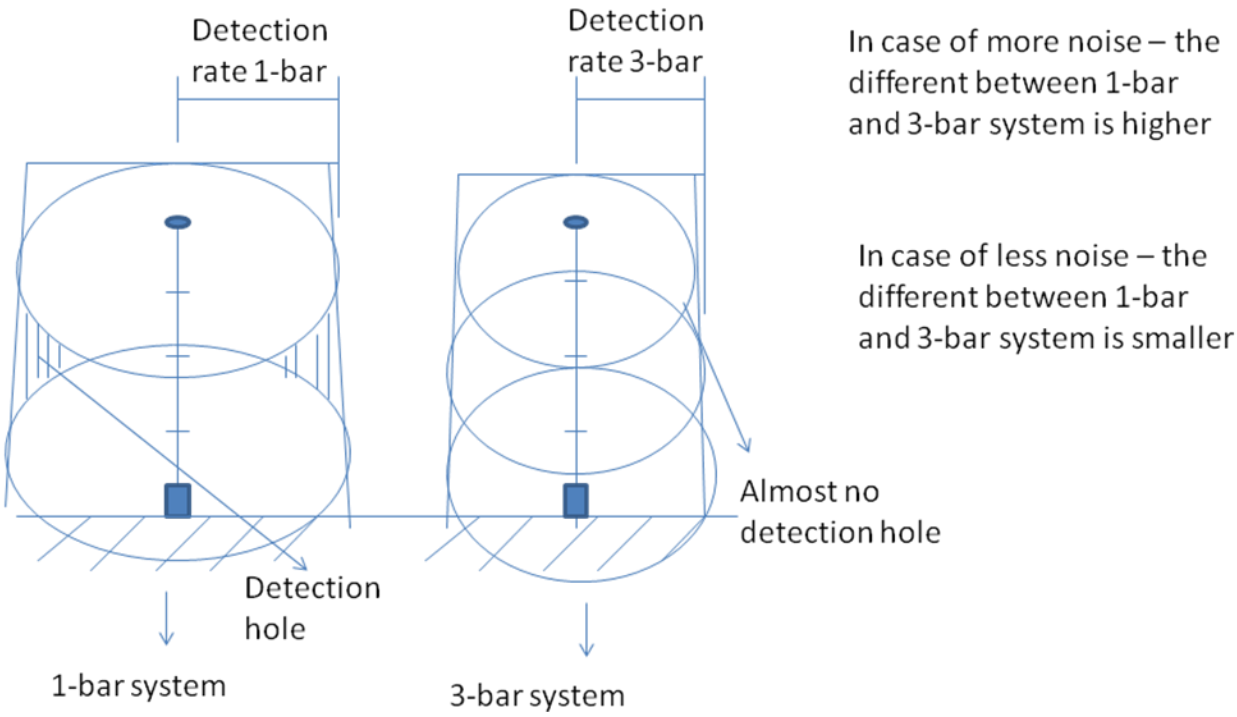
5.2 Detection distance for channel 1 & 2

Electronic board Mono 2k allows signal reception from 2 receiving antennas (single & double „8“ loop) located inside the same frame. Single „8“ loop is connected to pins 17 – 18 and double „8“ loop to pins 15 – 16.



The shape of the tag detection tree depends on the geometrical configuration of the “8” loops (single-8 & double-8). That means the location of horizontal bar.

The difference between a 1-bar and a 3-bar mono system



6. Installation of the IRD system

For the installation of the IRD system you do not need any complicated devices (e.g. oscilloscope). Recommended tools and equipment for **single-antenna installation**: drilling machine, screwdriver, pincers, and fasteners with appropriate screws. In case **of multiple-antenna installation**, you additionally need a wire for synchronisation of the individual systems. If the customer desires to cover this wire you will need covering rails for cabling (including fasteners and screws for rails installation). Other possibility is to hide the cable into a groove; possibly you will need floor saw, high-performance vacuum, and silicon sealer or cement jointing material - according to the floor kind and character of shop. Do not forget about the samples of tags for testing of detection distance.

6.1. Installation procedure

6.1.1. The location of installation

If it is possible, one should abide by the following recommendations when choosing a location of installation:

- the distance of the system from vertical electric conduits should be at **least 1 m**
- the distance of the system from huge metal constructions should be at **least 0.5 m**
- if it is possible, don't install the system **closer then 15 cm** from the wall or close to potential sources of noise as: air conditioner, switched-on power supplies, PC, power lines etc.

- if one needs to install the system in the proximity of large metal frame (shop window, window etc.), we fix it in a perpendicular position, if possible. Note: a plastic window, if it can be opened, can also have a metal frame. For parallel installation in the proximity of huge metal frames, false alarms can occur.
- leading supply cables should be as short as possible
- there should be no other appliances connected to the same inlet 230 V socket
- don't let a metal door be opened into the detection zone of the antenna

6.1.2. Provisional verification of the functionality of the system

We assemble the system on the chosen location of installation, connect it to the supply network and set the following parameters of the electronics board:

NodE – **NASt**

trNo – **SS4n**

rESP – **SloU**

SEnS – **SEHI**

tAGS – **PAPI**, or **HArd** depending on the used tags at the installation site
PAPI – detection of paper labels without their destruction required
HArd – only hard tags are used

GAIn – **Auto**

PoUt – 100%

dENo – **Auto**

Other parameters do not yet matter for temporary adjustment.

Turn the antenna off and on, wait for about 3 minutes, use the +, - to display the actual measured data. The displayed data represents the maximum measured value from the last 32 measurements in 0.64 seconds (50 Hz network frequency). In case the electronics detects error states for which it can not register the tag in the detection frame (can not declare an alarm), it signals (using both light and sound) a series of short beeps and flashes that repeat. The number of "beeps" characterizes the type of error (Chapter 9. Error messages). Press the +, - buttons to display parameters 3, 4.

3, 4 average background level in channel 1, 2 in %. The background level is the value of the input signal outside of frame transmission (background). In automatic gain setting mode the electronics board tries to set the background level between 35% to 41%. If the displayed value is less than 35%, there is a large resonance in the environment, or a tag is left in the antenna area. In this case, tag detection is already affected and the detection distance is shorter. The displayed value should never be greater than 44% in the automatic gain setting mode.

1, 2 input signal level in channel 1, 2 in %. The displayed signal value in channels 1, 2 may range from 35% to 87%. The closer the measured value is to the

background level (parameter 3, 4) of 35% to 41%, the better, as it indicates minimal environmental resonance (small environmental impact on frame detection). If the measured values do not change quickly, it means that the environment is more stable (without rapid background changes) and therefore less susceptible to false alarm generation.

5, 6 the level of resonance in the input signal. The resonance represents the difference between the level of the input signal and the average background level in the channel 1, 2 in %. Display 5 = channels 1-3, 6 = channels 2-4. A value of up to 20% is acceptable. If the value is greater than 20, the surrounding environment has a great impact on the frame detection, or there is a forgotten tag near the antenna.

7, 8 the gain of the signal in channel 1, 2. The gain is continuously set so that the background level is maintained at a level of 35% to 41%. A value of 25 to 100% is appropriate. Higher gain value is better because of the longer detection distance of the antenna. The gain value is significantly affected by the background signal level, the most unfavorable is the effect of permanent transmission (dual antennas nearby) or resonant metal objects (doors, windows, cables, ...). A value of less than 20% in both channels indicates a large effect on the detection distance. It is usually caused by two causes. The first cause is strong interference in the background, most likely caused by dual frames broadcasting nearby. In this case the level of persistent resonance is low (5, 6) and the background level is in the range of 35% to 41% of the usual values. The cause reflects itself only in a low gain. The second reason is the resonance in the antenna space or a forgotten tag. This cause can be identified by a high level of persistent resonance (5, 6) and a low background level (3, 4) of less than 35%.

9, 10 share of the input signal with an alarm value in %. A value of 100 is an alarm, the value of 50% indicates that the input signal has only half the level required to declare the alarm. The optimal value is 70% to 85%. A lower value of 70% indicates shorter detection distances but greater resistance to false alarms, a value higher than 85% indicates a longer detection distance but more false alarms.

11 total number of alarm level exceedings in channel 1. The number with a decimal point after the last digit is the total number of alarm level exceeded

in channel 2; display is constantly alternating. In the environment there may be random interference that exceeds the alarm signal level, electronics will recognize these random "alarms" and will not alert (unless they meet the alarm requirements) but any alarm level exceeding is recorded. In the ideal case 0 is displayed (no alarm level exceeding). This is true only if no alarm is displayed (display **12** shows 0). The alarm number can not be reset using the buttons, so it is suitable for monitoring the interference for a certain time. Based on these data, the possibility of false alarms can be assumed. The value is reset only by switching off the antenna, by power failure or by remote internet control (requires remote control module connection).

12 total number of alarms. The number represents the total number of valid alarms in Channel 1 and 2 together. If an alarm happens in channel 1 and 2 at the same time, it is recorded as a single alarm. The number of alarms recorded can not be reset. The value is reset only by switching off the frame, by power failure or remote internet control (requires remote control module connection).

Using a test tag, we check frame detection parameters. If we are satisfied with the detection parameters, no additional electronics settings are required, and we use the automatic settings.

If the detection distance is considerably small, the cause can be temporary or permanent interference. If the location of installation is changed in this case, the system detection will usually become higher. If this does not help, it can be the problem of temporary noise from the surrounding or very strong permanent noise. We wait a moment and if the reason for small detection was temporary noise, the detection distance usually becomes higher after repeated testing.

6.1.3 **Approval of place installation** by a responsible person (owner, business manager etc.)

Never forget to meet this important requirement. In case you forget, some installation problems can occur in the future.

6.1.4 Finally, fix the system to the floor. In case of **multiple** (two or more IRD systems) installations, set the synchronization of the individual antennas.

6.1.5 Check the detection parameters of the system once more and then hand over the installed set to the customer together with the operating manual.

7. Setting up the electronics board

Setting up the electronics board depends on how you install the IRD system.

7.1. Single IRD system installation

A single IRD installation is an installation where only one IRD system is installed at the installation site.

7.1.1. Single IRD system installation, no RF systems around

For the chosen method of installing the IRD system, the settings of the electronics board are the following:

Mode **NodE** – **NASt** for a single IRD installation, the MASTER IRD can only work in the MASTER mode.

Transmitting mode – **trNo**
SS4n – NETWORK SYNCHRONIZATION
InFr – INTERNAL FREQUENCY
Select the mode based on the interference at the installation site – network frequency synchronization (**SS4n**) is recommended.

Response **rESP**
SLoU – SLOW
FASt – FAST
The response of the alarm evaluation is selected according to the interference at the installation site. In case of irregular strong interference a reduced rate of evaluation can be set.

Sensitivity **SEnS**
SEHI – high for normal conditions
SELo – low sensitivity in environments with high interference
Set according to conditions at the installation site.

Tags **tAGS**
PAPI – paper tags detection without destroying them also required
HArd – only hard tags used
Set according to the tags used at the installation site.

Gain **GAIn**
Auto – automatic sensitivity control
NAnU – manual sensitivity control
We recommend automatic sensitivity settings – the system automatically adjusts the sensitivity. If a fixed sensitivity setting is required for some reason (for example, if the reception conditions at the installation site change quickly and unpredictably, which can lead to false alarms), the sensitivity needs to be set manually. The system sets the sensitivity for channels 1 and 2 according to the value set by the parameters **NAG1**, **NAG2**.

Manual Gain 1 **NAG1** – (Fixed sensitivity channel 1) is only relevant if the parameter **GAIn - NAnU** is between 0 and 100 % – set the desired channel value 1 as needed.

Manual Gain 2 **NAG2** – (Fixed sensitivity channel 2) is only relevant if the parameter **GAIn - NAnU** is between 0 and 100 % – set the desired channel value 2 as needed.

Power Out **PoUt**

0 to 100 % – set to 100%. The maximum transmitting power ensures the maximum detection distance of the tags. Lower transmitting power needs to be set if the detection distance is large and has to be reduced.

Delay Mode **dENo** – is relevant only if the parameter **trNo** is set to **SS4n**

Auto – automatic transmission delay setting

NAnU – manual transmission delay setting

We recommend setting **Auto** – in this case, at startup the IRD system detects the conditions in the entire time interval (in which it can broadcast) and sets the transmission so that the interference is the least.

With manual setting, a delay of 0.1% to 100.0% can be set in 0.1% increments.

Slave Sync **SLS4** – in this case the setting does not affect the operation.

Light time **L t1** – 1 to 50 seconds – set the desired value.

Sound time **S t1** – 1 to 12 seconds – set the desired value.

Sound repeat **S rP** – 0.1 to 1.0 second – set the desired value.

Sound volume **S uL** – 0 to 100 % – set the desired value.

Relay time **r t1** – 0 to 100 seconds – set the desired value.

Advertisement **AduE** – adjust according to the frame used.

Internal Frequency **InFr** – only relevant if **trNo – InFr.** Set the transmission frequency between 30 and 100 Hz.

Delay value **dEL4** – only relevant if **trNo** – **SS4n** and **dENo** – **NAnU** 0,1 to 100,0 %.

The parameter specifies the delay time of the antenna transmission after the network voltage crosses zero. Find the value at which the input signal level value – channel 1,2 is the smallest (received noise is the smallest in this case and the antenna has the best conditions for tag detection).

7.1.2. Single IRD system installation, other RF systems present nearby

For this installation method, the same setup procedure applies as in the previous case, with the following warnings:

If nearby systems are operating at a different frequency than 8.2 MHz, there is very little chance that any installation problems will occur.

If two-antenna systems (Dual) operating at 8.2 MHz are installed nearby, the level of interference strongly depends on the distance and relative position of the systems. The minimum distance between IRD systems should be 7 to 10 meters. Even if the distance is over 10 meters, it is important to check the detection distance of the system before the installation.

In the event that the interrupting system is closeby, the only practical possibility to reduce the interference is to reduce the gain of the antenna, therefore to set the Gain parameter to Manual (**GAIn** – **NAnU**) and set the parameters Manual Gain 1,2 (**NAG1**, **NAG2**) such that the interference is minimal. It usually helps to reduce the transmitting power of the interrupting systems, but this option is not always feasible (permission of the owner is required).

For Transmitting mode **trNo** – **SS4n**, two ways of delay settings are possible:

1. Automatic transmission delay setting **Delay Mode dENo** – **Auto**. When turned on, the system automatically searches for free broadcast intervals and starts transmitting at randomly selected free intervals.
2. Automatic transmission delay setting **Delay Mode dENo – NAnU**. In this case, the electronics sets the gain according to **Delay value** (**dEL4**).

By setting the network synchronization (**Transmitting mode trNo** – **SS4n**), manually setting the antenna gain (mode **Gain GAIn** – **NAnU** + changing the parameters **NAG1**, **NAG2**) and possibly manually setting the delay time (**Delay Mode dENo** – **NAnu** + changing **Delay value dEL4**) it is possible to reduce interference and achieve good detection distances.

In the event of a failure, try setting a mode without synchronization (**Transmitting mode trNo - InFr**) and use the **Internal Frequency InFr** to set the transmission frequency such that the interaction between the systems is as small as possible.

If possible, network synchronization is preferred because it allows you to add additional IRD system installations without having to connect them with a synchronization cable.

7.2. Multiple IRD mono systems installation

Multiple installation is the assembly of several IRD systems in proximity. By proximity we mean a distance within 10 meters of each other and in adverse conditions even more. Multiple IRD installation differs from single installation in that in addition to setting up the individual systems in terms of detection distance, the systems must be set so as not to interfere with each other.

Several methods can be used for systems' synchronization. Each one has its advantages and disadvantages. Therefore, a universal approach can not be recommended. A suitable method should be selected according to the installation site conditions.

7.2.1. Network synchronization

This method uses the fact that all systems are powered from the grid and the network frequency serves to synchronize the systems. On all systems, set the **Transmitting mode** parameter to network synchronization (**trNo** – **SS4n**). There are two options for delay setting according to the **Delay Mode** parameter.

1. Automatic transmission delay setting – Delay Mode (dENo – Auto)

After completing the mechanical installation, all systems must be shut down. Then, turn on the 1st system in the series, wait about 15 seconds for one piezo-siren beep and a flash of light (that is, the system has found a free position for transmission) and check whether it functions correctly and reaches the detection requirements. Then repeat this procedure with the 2nd, 3rd, up to the last system. If the system is unable to find a free broadcast interval, it will signal it by 7 piezo-siren beeps. **In this way, up to 6 systems can be operated.**

2. Manual transmission delay setting – Delay Mode (dENo – NAnu)

On each system, a different value for the **dEL4** parameter needs to be set. Each system then transmits during a different time and hence the systems do not interfere with each other. Transmission of one system takes 20% of the delay time. An example of a setting for 6 systems: On system 1, we set **dEL4** to 0.1%, on system 2 to 20%, on system 3 to 40%, on 4 to 60%, on 5 to 80% and on system 6 to 100%. The condition is that all six systems are powered from the same phase, and network adapters must have the same connection orientation. The setting is time-consuming and it is therefore preferable to use the previous synchronization mode (Automatic transmission delay setting).

7.2.2. No synchronization – Transmitting mode (trNo - InFr)

It takes advantage of the fact that each system can transmit at a different speed and therefore there can be no long-term interaction of the systems. On all systems, **Transmitting mode** (**trNo - InFr**) must be set, and a different broadcast frequency has to be set on each system (using the **Internal Frequency InFr** parameter) so that the systems transmit at different speeds.

This method of installation is simple, systems are less susceptible to network interference, but due to mutual influence, the detection distance may be less than with network synchronization.

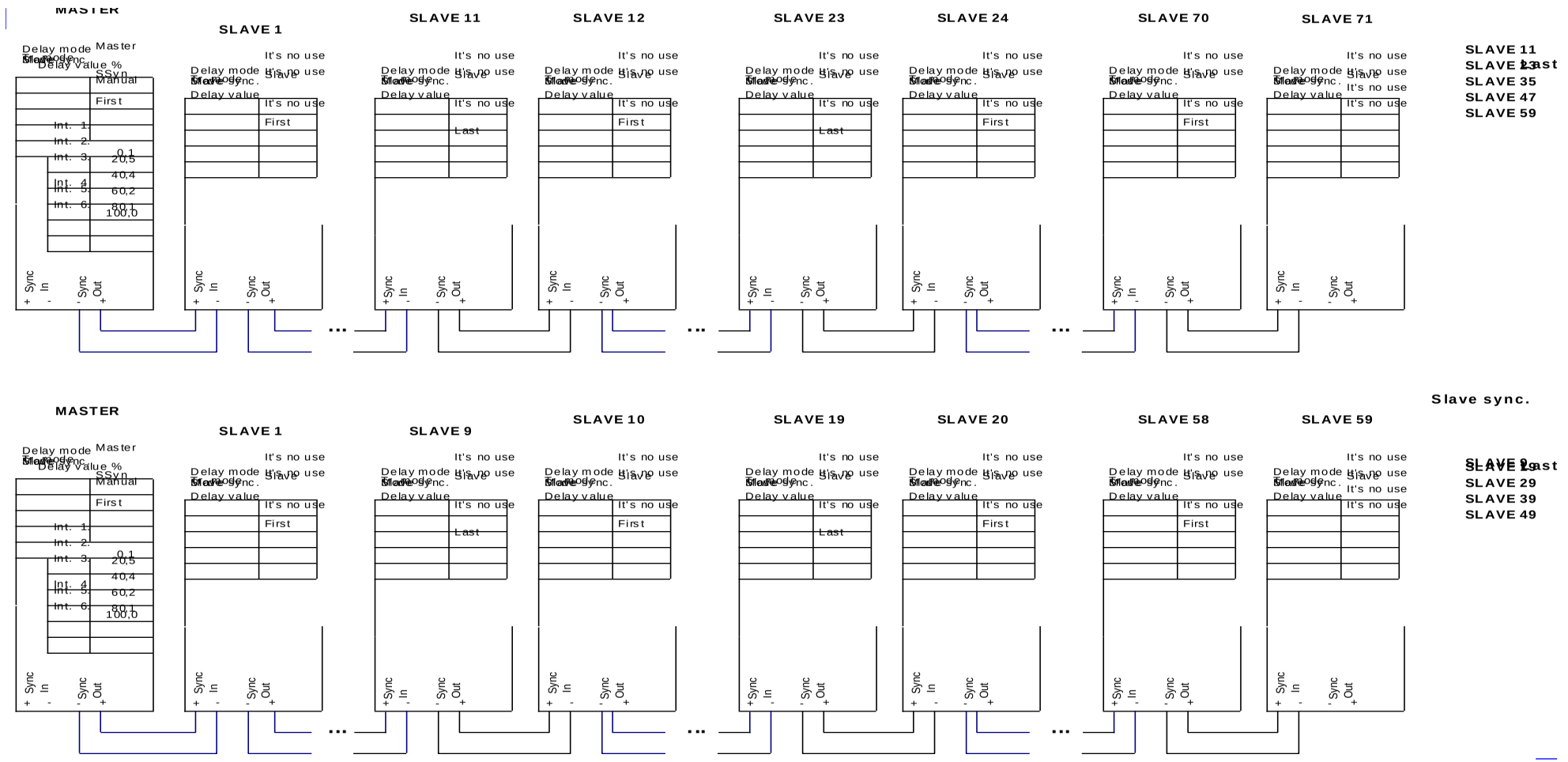
7.2.3. Synchronization MASTER-SLAVE

The IRD systems installed in this way are synchronized by a cable, therefore multiple systems cannot broadcast at the same time.

When installing, it is necessary to determine which system will work in MASTER mode **(NodE – NASt)** – usually it is the first system in the series (convenient cabling). All other systems must be set to SLAVE mode **(NodE – SLAu)**. Connect the synchronization cable to the SYNC OUT terminals of the MASTER system and the other end of the cable to the SYNC IN terminals of the next system in the series. Connect the next synchronization cable to the SYNC OUT terminals of the second system and the other end of the cable to the SYNC IN terminals of the third system. All systems must be connected in this way.

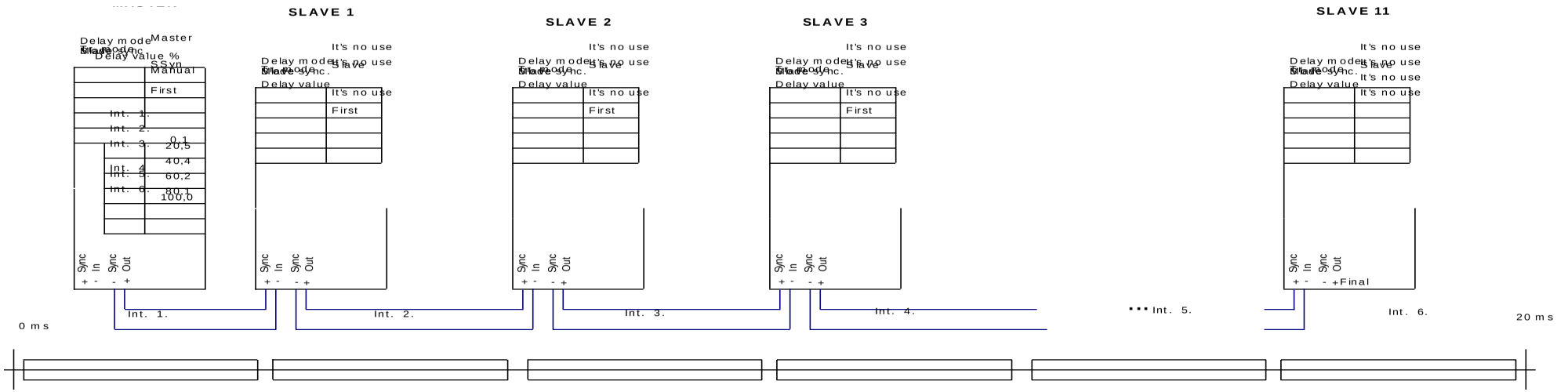
The MASTER system has a cable connected only to the SYNC OUT terminals, the last system in the series has a cable connected to the SYNC IN terminals only. If the synchronization cables are connected properly and all systems are turned on, LEDs on all systems will show **SYNC IN** (except for the MASTER system). For the correct synchronization, each twelfth (for the 60 Hz network every tenth) system has to have a **Slave Sync** parameter set to **SLS4 - LASt**, the other systems must be set to **SLS4 – FIrS** and the MASTER systems **(NodE – NASt)** must be set to **SLS4 – FirS**.

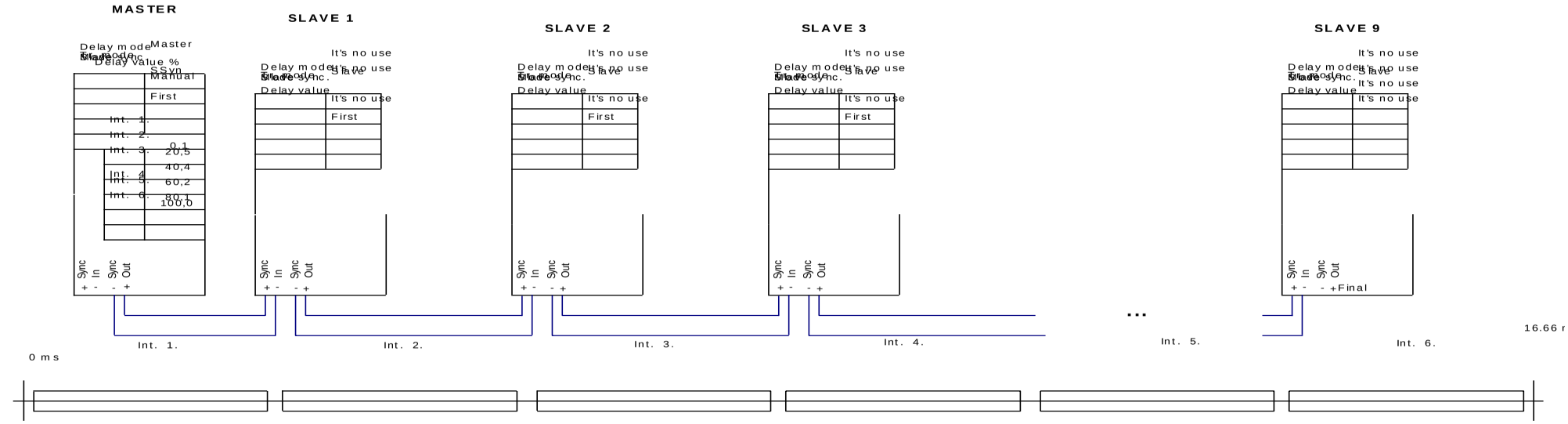
If the MASTER system works in network synchronization Transmitting mode **(trNo - SS4n)**, one can connect up to 72 systems for 50 Hz network frequency and 60 systems for 60 Hz network frequency. Connecting of the synchronization pulse wires and setting the **Slave Sync** parameter (**SLS4**) is depicted in the following figure.


MASTER
SLAVE 1
SLAVE 11
SLAVE 12
SLAVE 23
SLAVE 24
SLAVE 70
SLAVE 71
Delay mode
Master
Delay value %
SSyn
Manual
First
Int. 1
Int. 2
Int. 3
Int. 4
Int. 5
Int. 6
0,1
20,5
40,4
60,2
80,1
100,0
It's no use
Slave
Delay value
Last
Sync In
Sync Out
SLAVE 11
SLAVE 23
SLAVE 35
SLAVE 47
SLAVE 59
Slave sync.
MASTER
SLAVE 1
SLAVE 9
SLAVE 10
SLAVE 19
SLAVE 20
SLAVE 58
SLAVE 59
SLAVE 9
SLAVE 19
SLAVE 29
SLAVE 39
SLAVE 49

For large installations where deactivators are used, it is necessary to reserve the time for the transmission of deactivators so that they do not interfere with system detection and do not cause false alarms. In this case, it is advantageous to set the MASTER SLAVE mode in which one MASTER has a maximum of 11 (9 for 60 Hz) SLAVE systems, all of which must have the **SLS4 – FIrS** parameter set. Thus, it is possible to create 6 independent groups of 12 antennas for 50 Hz and 10 antennas for 60 Hz. Systems operating in MASTER mode **(NodE – NASt)** should be set to network synchronization transmission mode **(trNo - SS4n**) and manual transmission delay **(dENo – NAnu)**. They allow you to set the delay parameter **dEL4** (on MASTER systems) so that groups do not interfere with each other. At the same time, there will be 6 time intervals in which the deactivators can transmit without affecting the detection of the systems.

The limiting condition for setting the **dEL4** value on individual MASTER systems is that all six MASTER systems have to be powered from the same phase and network adapters must have the same connection orientation. An example of such an installation is in the following figure.


SLAVE 1
SLAVE 2
SLAVE 3
SLAVE 11
Delay mode
Master
Slave
It's no use
Delay value %
Manual
First
Int. 1.
Int. 2.
Int. 3.
Int. 4.
Int. 5.
Int. 6.
0,1
20,5
40,4
60,2
80,1
100,0
Sync In
Sync Out
+ - - +
Final
0 ms
20 ms


MASTER
SLAVE 1
SLAVE 2
SLAVE 3
SLAVE 9
Delay mode
Master
Slave
It's no use
Delay value %
Manual
First
Int. 1.
Int. 2.
Int. 3.
Int. 4.
Int. 5.
Int. 6.
0,1
20,5
40,4
60,2
80,1
100,0
Sync In
Sync Out
+ - - +
Final
0 ms
16.66 r

The Mono 2k system also allows you to set up large-scale installations using automatic network synchronization without MASTER systems being powered from the same phase or network adapters having the same connection orientation. The procedure is as follows

On all MASTER systems, set the **Transmitting mode** to **trNo – SS4n** and set the **Delay Mode** parameter to automatic transmission delay **dENo** – **Auto**.

With this setting, when the mains power is on the Mono 2k automatically detects which interval is free and starts broadcasting at this time. The information on the interval in which the board broadcasts and how many intervals are still available is displayed by pressing the **SAVE** button in the data control mode. For example, the electronics will show **In 1** telling us that the electronics will broadcast in the first interval, **Fr 4** informs us that there are still 4 free intervals in which additional electronics boards can broadcast.

The information about which interval is used for transmission and how many are still free is displayed in the initial tests, but only if the **Transmitting mode** is set to **trNo - SS4n** and **Delay Mode** to **dENo – Auto**. The number of free intervals (e.g. **Fr 5**) informs that the electronics has detected 5 free intervals. Afterwards, the electronics shows the interval in which it will transmit e.g. **In 1** informs that the electronics will broadcast in the first interval. In this example there are still 4 free intervals in which other electronics can transmit.

After installation, turn off all systems. Then the first MASTER system is switched on together with all SLAVE systems synchronized by the first MASTER system. The correct system operation is checked and the second MASTER system is also switched on together with all SLAVE systems synchronized to the second MASTER system. Check the correct operation and turn on the next system. Connect and review all systems in this way. Systems remember their settings even after being turned off. Pressing the **SAVE** button on the MASTER system allows us to determine the interval in which the electronics board is transmitting, then switch to the **Delay Mode dENo** – **NAnU** and set the delay Delay value **dEL4** on the electronics as follows:

1. interval **dEL4** 0.1
2. interval **dEL4** 20.5
3. interval **dEL4** 40.4
4. interval **dEL4** 60.2
5. interval **dEL4** 80.1
6. interval **dEL4** 100.0

This will ensure that in the event of accidental interference while the network is being switched on, there will be no change in the interval that could lead to malfunction of the installation. **For proper functioning, the orientation of network adapters must not be changed after finishing the installation!**

If the MASTER system works in no-synchronization mode (**trNo - InFr**), the number of systems that can be connected in a series depends on the **InFr** parameter setting. At 100 Hz it is 38 systems, for 30 Hz it is 128 systems.

8. System installation and electronics setup in a noisy environment

If there is too much interference and the system does not work reliably (many false alarms, piezo-siren beeps repeatedly), it is necessary to set parameters for difficult conditions:

1. Transmitting mode — **trNo – SS4n**, network synchronization 50(60) Hz
2. Gain — **GAIn** – **Auto**
3. Delay Mode — **dENo** – **Auto**
4. Response — **rESP – SloU**
5. Sensitivity — **SEnS** - **SELo**.

If the problem persists, set **Delay Mode dENo** – **NAnU** (manual network synchronization) and by tuning the **Delay value (dEL4)** try to reduce the interference.

If you did not manage to eliminate false alarms, set the **Gain** parameter to manual gain setting (**GAIn** – **NAnU)** and use **Manual Gain 1, 2** (**NAG1**, **NAG2)** to reach operation without false alarms. Set the **Transmitting mode** to **trNo – InFr** (without network synchronization), set automatic gain adjustment (**GAIn** – **Auto)** and by changing the Internal Frequency (**InFr)** parameter try to reach operation without false alarms.

9. Error messages

They are signaled by a sound and light series of short repeating beeps and blinks. The number of "beeps" characterizes the type of error. Error messages also indicate that the system can not register the tag in the system's detection area. The errors are also displayed on the display.

# of beeps	Type of error	Removal method
1	internal electronics board error	call service.
2	a tag permanently within reach of the system	remove the tag. Light signaling only
3	absent synchronization at SYNC IN input in SLAVE mode	check the synchronization cable. Light signaling only
4	network synchronization absent	call service if the board is powered by AC / AC power adapter, or change **Transmitting mode** to **trNo - InFr** if the board is powered by a DC source.
5	very weak detection	There is an object with strong resonance nearby
6	interference in the system area is large	if the Gain is set to manual (**NanU**), lower the antenna gain by tuning the parameters **Manual Gain 1, 2** (**NAG1**, **NAG2)**. If the Gain is set to **GAIn** – **Auto**, call service.
7	no free interval for transmission	Set the parameter **Delay Mode** to manual (**dENo** – **NAnU**). If the Delay Mode was already set to **NAnU**, call service
8	internal error	call service
9	internal error	call service