IKUSI

OPERATION & INSTALLATION MANUAL

TM70

PUSHBUTTON TRANSMITTERS

T70/1 and T70/2 MODELS

IKUSI

I N DEX

Pag.

IKUSI

1.- DECLARATION OF CONFORMITY (870MHz ISM BAND)

DECLARACION DE CONFORMIDAD
CONFORMITY DECLARATION
KONFORMITÄTSERKLÄRUNG
DECLARATION DE CONFORMITE
DICHIARAZIONE DI CONFORMITA'
DECLARAÇAO DE CONFORMIDADE
VERKLARING VAN GELIJK VORMIGHEID

CE 0341

El Fabricante	ANGEL IGLESIAS, S.A.
The Manufacturer	Paseo Miramón 170
Der Hersteller	SAN SEBASTIAN - SPAIN
Le Fabricant	NIF: A-20-036.018
Il Fabbricante	Tel : (+34) 943 448800
O Fabricante	Fax: (+34) 943 448819
De Fabrikant	www.ikusi.com

Declara que el producto: Telemando IKUSI
Declares that the product: Remote Control IKUSI
Erklärt, dass das Produkt: Funkfernsteuerung IKUSI
Déclare que le produit: Télécommande IKUSI
Dichiara che il prodotto: Radiocomando IKUSI
Declara que o produto: Radiocomando IKUSI
Verklaart dat het product: Radiobesturing IKUSI

TM70/1 - 870
TM70/2 - 870

Cumple con las Directivas de Consejo:
Complies with the provisions of Council:
Erfüllt die Richtlinien des Rates:
Accompli les Directives du Conseil:
E´conforme alle Direttive del Consiglio:
Cumpre as Directivas del Consello:
Conform is met de richtlijnen van de Raad:

98/37 EEC MACHINERY
99/5 EEC R&TT

Normas armonizadas utilizadas:
Applied harmonized standards:
Angewendete harmonisierte Normen:
Normes harmonisées utilisées:
Norme armonizate utilizzate:
Normas harmonizados aplicados:
Volgens geharmoniseende normen:

ETSI EN 300220-1 V1.3.1
ETSI EN 300220-3 V1.1.1
ETSI EN 301489-1 V1.6.1
ETSI EN 301489-3 V1.4.1
EN 55022 : 1994
EN 61000-4-2 : 1995
EN 61000-4-3 : 1996
EN 61000-4-4 : 1995
EN 61000-4-5 : 1995
EN 61000-4-6 : 1996
EN 61000-4-11 : 1994
EN 61000-3-2 : 1995
EN 61000-3-3 : 2001
EN 60950-1 : 2001
EN 50178 : 1998
EN 60204-32 : 2001
EN 60529 : 2000
EN 13557 : 2004
EN-954-1 o EN 13849 : 2004

San Sebastián

Luis Ayuso Jauregui

Director de Calidad

02/07/2007

IKUSI

2. - DECLARATION OF CONFORMITY (433MHz ISM BAND)

DECLARACION DE CONFORMIDAD
CONFORMITY DECLARATION
KONFORMITÄTSERKLÄRUNG
DECLARATION DE CONFORMITE
DICHIARAZIONE DI CONFORMITA'
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VERKLARING VAN GELIJK VORMIGHEID

CE 0341

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Dichiara che il prodotto: Radiocomando IKUSI
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Verklaart dat het product: Radiobesturing IKUSI

TM70/1 - 433
TM70/2 - 433

Cumple con las Directivas de Consejo:
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ETSI EN 300220-1 V1.3.1
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EN 61000-3-3 : 2001
EN 60950-1 : 2001
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EN 60204-32 : 2001
EN 60529 : 2000
EN 13557 : 2004
EN-954-1 o EN 13849 : 2004

San Sebastián

Luis Ayuso Jauregui

Director de Calidad

02/07/2007

3.- SYSTEM DESCRIPTION

The TM70/1 and TM70/2 push-button transmitter type, radio remote control systems are designed for the remote control of hoists and cranes, and are particularly suitable for applications when the operator needs to be able to choose the best location from which to carry out an operation.

The system consists of a transmitter for selecting commands and a receiver, which is connected to the electrical system of the machine to be operated. The system also comes with a battery charger and two rechargeable batteries.

The main specifications are as follows:

The TM70

Frequency band	869,700 to 870,000 MHz; ERP <5mW 433,050 to 434,040 MHz; ERP <1mW 434.040 to 434.790 MHz; ERP <10mW 902.000 to 928.000 MHz; ERP <1mW
Response Time	100 ms
Temperature range	-20º to +70ºC

The T70/1 and T70/2 Transmitters

Ingress protection	IP65 / NEMA-4

The R70/13 and R70/21 Receivers

Power supply	48, 115, 230 Vac ± 10%, 50/60 Hz Optional 12 or 24 Vdc
Consumption	20 W
Relays	230 Vac/8 A
STOP Relays	230 Vac/6 A
Protection	IP65 / NEMA-4
Electrical Security	Class II (EN50178)

The CB70/BC70K battery charger

Power supply	230 Vac ± 10%, 50Hz; optional 115 Vac, 60 Hz; DC Range: from 10,5v to 35v

The BT06K battery

Voltage	4.8 V
Capacity	750 mAh NiMH
Charging temperature	0º to 45ºC
Discharge temperature	-20º to 50ºC
Autonomy	10 h (operating at 50%)

4.- SAFETY INSTRUCTIONS

These instructions must be read carefully in order to install and use the set properly and to keep it in perfect working condition and to reduce the risks of misuse.

Do not use this set on machines in potentially explosive atmospheres.

Any use other than that specified in this manual is dangerous. The following instructions must be strictly adhered to.

4.1 - WHAT YOU MUST DO

- Strictly adhere to the instructions for installation contained in this manual
- Make sure that professional and competent personnel carry out the installation.
- Ensure that all site and prevailing safety regulations are fully respected.
- Make sure that this manual is permanently available to the operator and maintenance personnel.
- Keep the transmitter out of reach of unauthorised personnel.
- Remove the transmission key when the set is not in use.
- On starting each working day, check to make sure that the STOP button and other safety measures are working.
- When in doubt, press the STOP button.
- Whenever several sets have been installed, make sure the transmitter you are going to use is the right one. Identify the machine controlled on the label for this purpose on the transmitter.
- Service the equipment periodically.
- When carrying out repairs, only use spare parts supplied by IKUSI dealers.

4.2 - WHAT YOU MUST NOT DO

- Never make any changes to the set, which have been studied and approved by manufacturer.
- Never power the equipment other than with the specified power supply.
- Never allow unqualified personnel to operate the equipment.
- After use, never leave the equipment ON. Always use the contact key or the STOP button to avoid accidentally activating manoeuvres.
- Do not use the set when visibility is limited.
- Avoid knocking or dropping the set.
- Do not use the set if failure is detected.

4.3 - FCC RECOMENDATIONS (Only valid for equipment that works in 915MHz ISM band)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and

2. This device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

To comply with FCC RF exposure compliance requirements, this device and its antenna must not be co-located with, or operating in conjunction with, any other antenna or transmitter.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

5.- INSTALLATION

5.1 - THE CB70 (BC70K) BATTERY CHARGER

The battery charger CB70 (or BC70K) has two charging compartments that can simultaneously charge battery types BT06, BT12 (TM60 series) and BT06K, BT20K (TM70 series).

Connect the charger to the mains using the power source and cable supplied. On installing the battery charger, bear in mind that the batteries must be charged at temperatures over 0ºC and that the power supply must be left on all night.

Place the batteries in the charger. Please wait about 5 seconds between consecutive insertions of batteries in their locations.

Each battery location has a green led indicator associated.

Green led indications:

1) Green led blinking: it indicates that the battery is excessively unloaded ; when the led finishes blinking it indicates that the normal loading operation mode has begun.

2) Green led permanently lightning: it indicates normal loading operation mode.

3) Green led extinguished: it indicates that the battery loading process has finished.

The capacity of the batteries decreases with use. Their life span is estimated to be 500 recharging cycles, but this depends largely on the conditions of use, for which the following is recommended:

- Do not recharge the battery until it is completely flat. The transmitter indicates this moment.
- Always charge the batteries at temperatures between 0º and 45ºC (the batteries will not become fully charged at temperatures exceeding 45ºC). Remember that the charger must not be left in direct sunlight.
- Charge the batteries at least once every six months.
- Avoid short-circuits between the battery contacts. Do not carry charged batteries in toolboxes or next to other metal objects (keys, coins, etc.).
- Always keep contacts clean.
- Never leave batteries in direct sunlight.

Warning: if the battery charger is powered with lower voltage than 10,3v DC, the green led indicates battery in charging process, even if there is no battery placed in the charger.

- Only use IKUSI manufactured batteries
- The exhausted batteries must be disposed of or recycled safely according to local standards

Ex

- The IKUSI - ATEX batteries (BT06K-ATEX and BT20K-ATEX), only can be re-charged with the BC70K or CB70 battery charger.

5.2.- RECEIVER

Make sure that the crane is stopped for the entire duration of the assembly process, keep the work area free and wear protective clothing.
Park the crane and position stop-ends (if these are not available use appropriate signs) at a suitable distance so that other cranes on the same runway do not hit it.
Check the power-supply voltage and turn off the mains switch.
Remember that the receiver has several voltage-powered circuits. Even when the power has been cut off, there is still a risk of electrical shocks.

Find a suitable location for the receiver with easy access, in a place designated for reception of the radio transmitter signal, and away from any intense radio electric disturbance sources.

Install the receiver cabinet using 4 elastic absorbers.

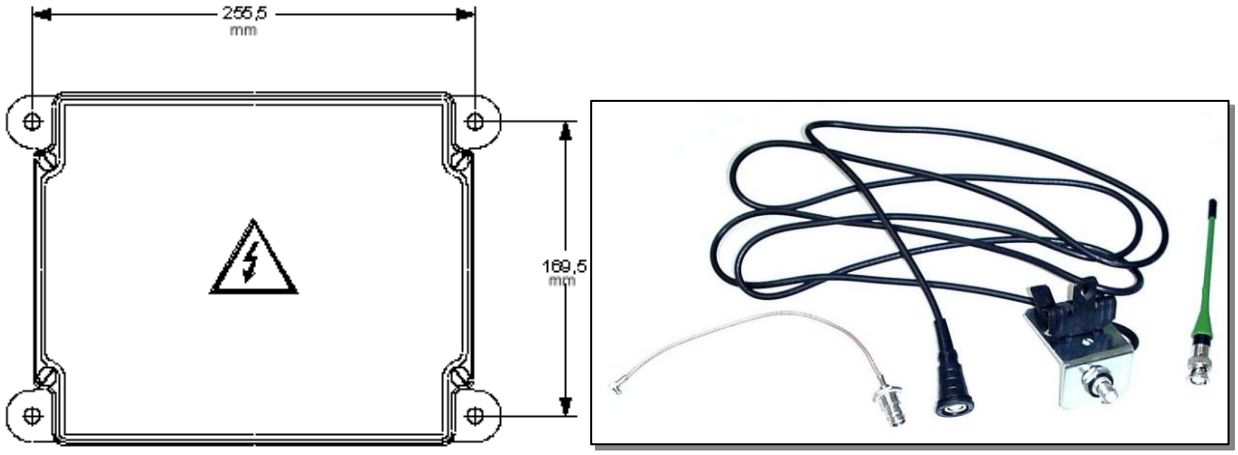


Figure 3. Receiver, external antenna and cable extension cables kit.

If necessary, it is possible to improve signal reception, by using the extension cables and external antenna kit. This kit is applicable only for non-transmitting receivers.

Connect the power supply and the receiver outputs on the corresponding relay board plug-in terminals. Do this following the outputs diagram, which is supplied with the set. This diagram indicates the correspondence between the transmitter commands and the receiver outputs.

The STOP relays KSTOP1 and KSTOP2 are in series and must be connected to the main contactor coil circuit.

The K2/START is activated once the start-up command is held down.

The K1/SAFETY relay is a safety relay, which is activated when certain commands predefined as “active” on configuration of the set, (i.e. commands which give rise to manoeuvres), are activated.

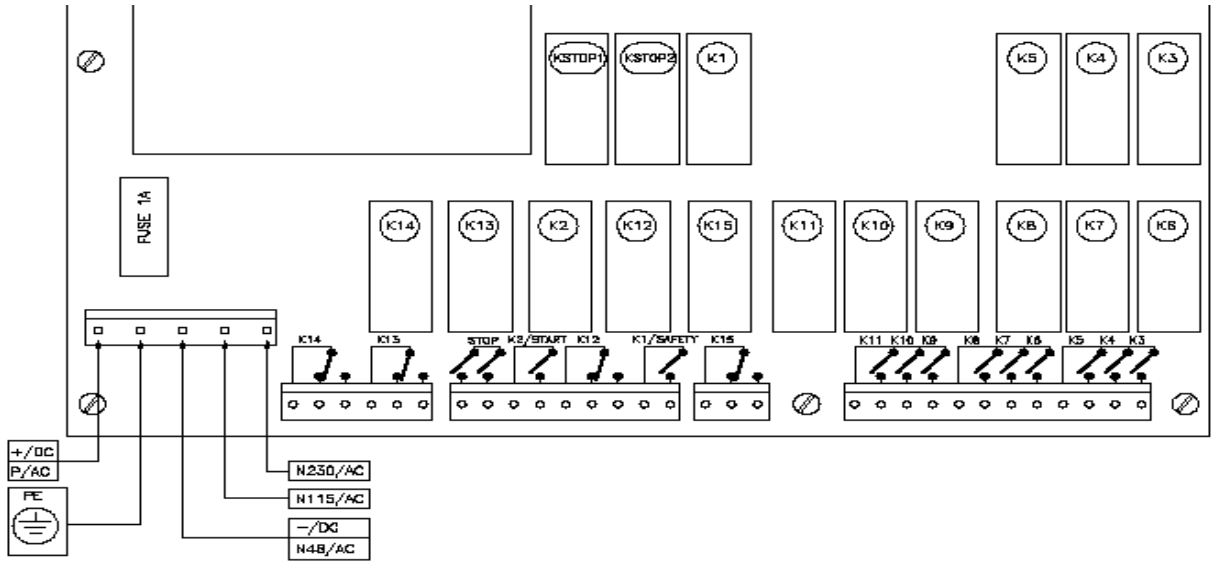


Figure 4. Receiver’s electronic card

Remember to connect the ground cable.
Only use fireproof cables for connections.
Select the appropriate voltage on the receiver, (230, 115 or 48 Vac – 12 OR 14 Vdc)

5.3 - STARTING UP

Proceed with caution; the equipment may not be connected correctly which may lead to unforeseeable movements on starting-up.

Once the receiver has been connected, disconnect the power supply to the motors, (for example, by removing the fuses) and power on the receiver. First of all the LEDs will light on an instant to test that all are all right, after this the receiver will enter into a 'SCANNING' mode and the following LED's will be lit in the receiver;

POWER (1):	ON, indicates that the power supply is correct.
HARDOK (2):	ON, indicates the absence of faults on the boards.
SIGNAL (3):	OFF, in the case of the channels being signal free. Blinks ON when there is a RF signal on the channels.
DATA (4):	OFF, when there is not another TM70 system active in the area. Blinks ON in the opposite case.
ID (5):	OFF
CAN_RUN (6):	ON, Indicates that CAN communications with expansion boards are OK.
CAN_ERR (7):	OFF
ORDER (8):	OFF
RELAY (9):	OFF

Figure 5. Signalling LEDs in the receiver.

1.- Label for crane identification.
Optional: LCD Display.

2.- LED.

3.- Manoeuvre button.

4.- Contact key.

5.- Start button.

6.- STOP button.

7.- Option: Range Limitation.

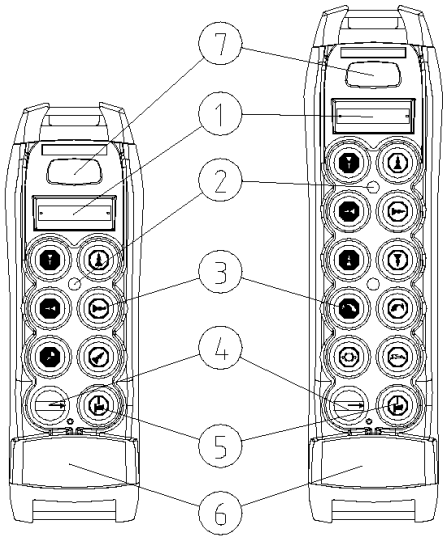


Figure 6. Command and signalling elements in the transmitter

Next, turn transmitter ON to OPERATION mode, as follows:

- Place a charged battery in the transmitter.
- Turn the contact key.
- Push and pull out the STOP button, (LED flashes orange-green). If the transmitter has LCD, it displays the identification of the machine, as well as the battery level.
- Press the start button. The green LED should now light indicating that the transmitter is transmitting.

On receiving a signal from the transmitter, the receiver enters in OPERATION mode; the following LED's will light up on the receiver:

POWER: ON, indicates that the power supply is correct.

HARDOK: ON, indicates that defects have not been detected on the board.

SIGNAL: ON, indicates that it is receiving a RF signal at the working frequency.

DATA: When ON indicates that the data received has a correct format.

ID: When ON indicates that the receiver has recognised the transmitter's identification code.

CAN_RUN: ON, Indicates that communications with CAN expansion boards are OK.

CAN_ERR: OFF

ORDER: ON, Indicates the activation of any digital manoeuvre

RELAY: ON, Indicates the activation of STOP relays

Now, the STOP relays KSTOP1 and KSTOP2 will be activated. The K2/START relay is activated once the start button is pushed.

Press on any of the transmitter's manoeuvre buttons and its corresponding relay will be activated. In case of an active manoeuvre, the safety relay K1/SAFETY will also activate.

Check to make sure all the other manoeuvres work in this way.

Turn off the transmitter using the STOP button, and make sure that on doing so the relays are deactivated and the DATA, ID and SIGNAL LED's go out. They behave exactly as in 'SCANNING' mode.

Reconnect the power supply to the motors, move to the usual work position and check to see if all the manoeuvres and the stop button are functioning correctly.

IMPORTANT REMARK:

IKUSI does not take responsibility of an incorrect installation, interferences produced by collision of frequencies, nor of the management of the working frequencies in fixed facilities, where several radio remotes systems, share or can share, the same zone or working area.

6.- USING THE SET

To ensure correct use of the equipment, follow the instructions below:

- Make sure the transmitter you are going to use is the right one, identifying the machine on the identification label. In the case of transmitters with LCD display, you are able to edit the machine identification label, (ANNEX B). It will allow to the operator to identify the machine before the starting of the equipment.
- Attach the belt to the transmitter unit. Its use is recommended to prevent the equipment from falling.
- Introduce a charged battery, turn the contact key and activate the transmitter.
- To activate the system, you must first pull out the STOP button, the LED should then give an orange-green pulse; then press the START button. If you find that the STOP button has already been pulled out, it is necessary to push it in and then pull it out again, as this sequence will allow the check in of the STOP circuit. If the unit has experienced a time-out auto-disconnection, it is not necessary to repeat the STOP button procedure, simply push the START button for 1 second.
- The green LED should light up, indicating that the transmitter has started transmitting. From now on, if any of the transmitter's command buttons are pressed, the corresponding manoeuvre will be activated.
- To be able to start up the transmitter, all the command controls associated with active manoeuvres must be in the neutral position (not activated). This is not the case for the selection functions.
- When 4 minutes have passed and no active manoeuvre command has been activated, the transmitter automatically goes to STAND BY mode, indicated by green pulses each 3 seconds. To start it up once more, press the start button.
- The transmitter is equipped with a circuit for monitoring the battery level. When this level drops below a pre-established limit, the transmitter LED starts to flash in red; 5 minutes later the transmitter switches off, and the machine's main contactor is deactivated. During this time, the load has to be located on a safe position. If the STOP button is activated during this time, transmitter will not start again, unless battery is replaced.
    - In transmitters with LCD, the battery power level is indicated as follows:
    - 3 segments: charge greater than 50%.
    - 2 segments: charge between 50 and 10%.
    - 1 segment: charge between 10 and 5%.
    - Nothing: charge lower than 5%.
    - To switch off the transmitter, press the STOP button or turn off the contact key.

Remember that you are going to remote control a moving piece of machinery. The safety instructions described in chapter 2 of this manual must be strictly adhered to.

7.- MAINTENANCE

7.1.- WARRANTY

IKUSI guarantees the **TM70** remote control sets for a period of up to one year after the date of delivery. This guarantee covers repairs and the replacement of defective pieces at our Technical Service Department. Both the transmitter and receiver will be necessary if any repairs or replacements need to be carried out.

The guarantee does not cover damage resulting from the following:

- Transport.
- Incorrect installation.
- Repairs or alterations made to the equipment by personnel other than from IKUSI.
- Obvious misuse or incorrect maintenance of the equipment.

Our Technical Service reserves the right to evaluate breakdowns and damage.

Under no circumstances will IKUSI be held responsible for hold-ups at work, accidents or expenses incurred as a result of equipment malfunctioning.

7.2.- PRECAUTIONS

This equipment is designed for use in an industrial environment. However, we recommend you follow the instructions below to extend the life span of your remote control set:

- Use the belt provided with the transmitter to prevent the transmitter from falling.
- Do not clean the transmitter with solvents or pressurised water. Use a damp cloth or soft brush.
- Use and recharge the battery regularly.
- Check every day that the STOP pushbutton is working.
- Disconnect the receiver cables if soldering/welding work is going to be carried out on the crane.
- Periodically check the condition of the transmitter rubber seals. Change these over if they show signs of deterioration to ensure they remain watertight.
- Clean the battery contacts.

7.3 - TROUBLESHOOTING

The transmitter and receiver have status monitoring LED's, which help to identify irregularities. The most common signals are contained in the tables below:

TRANSMITTER

LED	MEANS
Solid green	Transmitter transmitting normally. OPERATION mode.
Green pulses.	Transmitter ready for start-up. STAND BY mode.
Red slow flashing	Battery level low
Red fast flashing	Probably, EEPROM module is not plugged in.
Red double flashing	Transmitter cannot start up because a manoeuvre command is present.
Solid red	Transmitter failure

RECEIVER

In OPERATION mode the 7 LED's must be lit as has been previously described in section 4.3 Starting. If this is so, press the transmitter manoeuvre buttons and observe the response of the output relays. If the response is normal, the problem is not related to the remote control equipment and the installation must be checked. If any of the relays is not activated, the problem is associated with the remote control equipment. If this happens, observe the appearance of the LED's:

LED	LIT	FLASHING	OFF
POWER	Power Supply OK	--	Power Supply not OK
HARDOK	Board OK	Slow: fault in the board Fast: error in EEPROM	Fault in the board
SIGNAL	RF signal OK	RF signal detection in SCANNING mode	The receiver is not receiving RF signals
DATA	--	Is receiving the correct data from a TM70	Signal received is not correct
ID	--	ID Code OK	ID not recognised
ORDER	Any digital manoeuvre ON	--	No digital manoeuvre ON
RELAY	STOP relays ON	--	STOP relays OFF

There are also two LEDs in the receiver (only available in LR72 electronic card) which informa about the status of the CAN-BUS. If the CAN connection is not working, check the status of the LEDs:

LED	LIT	FLASHING	OFF
CAN_RUN	Operating status	Pre-operating status	CAN communication non active
CAN_ERR	Communication OK	Communication error	CAN controller disconnected

If the problem is associated with the equipment, please send both the transmitter and the receiver to the your Technical Assistance Service Agent, together with a description of the problem and the status of the LED's.

If the transmitter becomes so damaged that a spare has to be arranged, it can be quickly substituted by following the instructions in ANNEX A.

Display error messages V 2.4:

Error message	Cause
"Tilt switch "	Inclinometer detected due to an incorrect position of the transmitter
"Out of Range"	Transmitter out of range
"Wrong Crane "	Crane selector is in wrong position after a crane has been selected previously
"Error EEP"	Error when trying to access the content of the EEPROM or the internal memory. The content of the EEPROM cannot be copied into the internal memory
"Error Wrong EEP"	EEPROM data corrupted
"Error Copy FLASH"	When duplicating EEPPROM modules a copy failure occured during the new EEPROM updating process
"Error Open File"	Internal memory access failure
"Error File Write"	Error when writing EEPROM data into the flash memory or timeout error occured when trying to access to the memory
"Error File Close"	Error when trying to close the internal memory access
"Error Open Radio"	The radio cannot be opened
"Error Write Radio"	Data cannot be written in the radio
"Error OP & Masc"	When releasing the STOP pushbutton the signals and the masks do not match indicating that some masked order is still activated.
"Error Bad data EEP"	EEPROM data corrupted
"Error LAL not open"	Error when trying to open the range limiter
"Error Read LAL err"	Range limiter data cannot be read

ANNEX A - PROGRAMMING A SPARE TRANSMITTER.

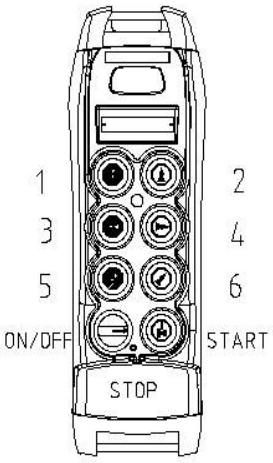
In case of damage to the transmitter, it is quickly possible to restore service, if a spare transmitter is available. To achieve this we have to install into the spare transmitter the exact parameters of that to be replaced.

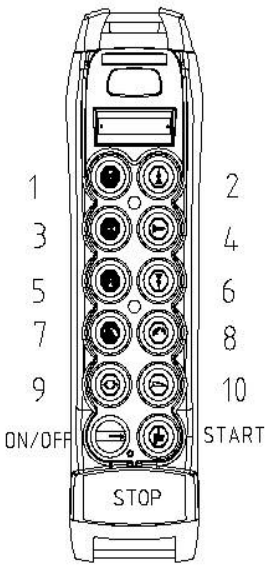
These parameters are stored in an EEPROM memory module, EP70, easily accessible from the exterior of the transmitter. Switch off the damaged transmitter and extract the EP70 module by unloosening the two screws, as shown, and then incorporate this module into the spare transmitter.

In cases where the damage to the transmitter prevents removal of the EP70 module, the spare transmitter can be programmed with the memory module EP70 found inside the receiver.

To achieve this, proceed as follows:

1. Being the spare transmitter off, remove its empty EP70 module as described above, and insert the EP70 module from the receiver.
2. Introduce a charged battery, turn on the ON/OFF key, push and extract the STOP button. The LED will pulse green for around 15 seconds.
3. To copy its contents into the internal memory of the transmitter press pushbutton 6 followed by START, keeping both buttons pressed together while LED blinks red. Once the LED start to blink orange, release the pushbuttons and LED will lit green. In the LCD display models the words “Reading...” and “Reading ok Change EEP” will be indicated. In case the LED remains in red colour, (or the LCD displays “Reading nok”), repeat the process.
4. When the copying process has completed, extract the EP70 and replace it into the receiver. Insert the empty EP70 into the spare transmitter and again press pushbutton 6. The LED will flash orange, which indicates that the empty EP70 is being written with the stored parameters In the LCD display models the words “Writing...” and “Writing ok” will be indicated. In case the LED remains in red colour, (or the LCD displays “Writing nok”), repeat the process.
5. Afterwards press the STOP. This completes the programming processes.

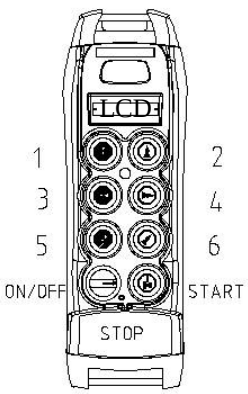


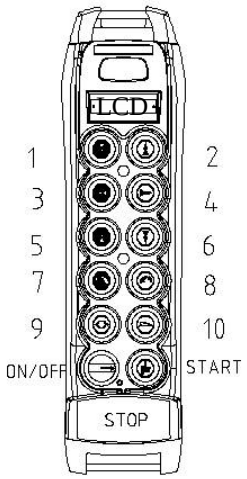


ANNEX B.- PROGRAMMING THE MACHINE IDENTIFICATION IN LCD TRANSMITTERS.

Transmitters with the LCD display option allow the operator to programme a machine identification label of up to 24 text characters. This identification is displayed on transmitter starting-up.

This text must identify the machine with a name that is commonly known by the workmen. When first starting the transmitter you can edit/introduce this text as follows:





1. Introduce a battery and turn the ON/OFF key to ON.
2. Push in and then extract the STOP button and you will observe the LED pulse orange-green.
3. Press pushbutton 4 followed by START button and keep both pressed together during 3-4 seconds and then you will enter the “CONFIG MODE”. Press pushbutton 4. (press TWICE pushbutton 4 if it only appears the option “CONFIG MODE”).
4. Move through the menu with pushbuttons 1 and 2 until reaching the EDIT LABEL menu. Press push button 4.
5. Once you have entered into EDITING mode, there appears in the display the text "CRANE ??" in which the first character blinks. From this point you can edit the name of the machine by means of the push buttons 1 to 4, whose functions are described as follows:
   - Pushbutton 1: To move for the list of established characters in descending order.
   - Pushbutton 2: To move for the list of characters established in ascending order.
   - Pushbutton 3: To return to the previous character in the display.
   - Pushbutton 4: To validate the published character and move to the following one, (towards the right hand)
6. Push START to store the edited text. LCD will show the message “SAVED” for 2 seconds.
7. You exit the EDITING mode by pressing the STOP.

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8.- FREQUENCY CHANGE

FREQUENCY CHANGE

TM70

8.1 - SYSTEM DESCRIPTION

The TM70 radio system contains synthesized frequency radio modules in both transmitter and receiver which are microprocessor controlled. This allows us to change the radio frequency via the transmitter in a simple way and the receiver will automatically search for this new frequency.

8.2 - DEFINITIONS

ALLOWED CHANNELS (CP): is a list of authorized channels, (maximum 70). These are factory defined and are not modifiable.

BASE CHANNEL (CB): this channel is defined as the Working Channel and these channels are exportable; factory defined, it can be modified via the progamation mode. It is an inferior Working Channel.

WORKING CHANNEL (CT): the working radio channel; it is defined as a displacement from the CB. In the equipment that has this option, the CT is modifiable by the user via the transmitter, by means of a command to carry out this effect.

EXPLORABLE CHANNELS (EC): they are the CT defined working channels, (maximum 16), that the receiver is able to fast scan. The rest of the CP channels are also scanned although with a smaller priority.

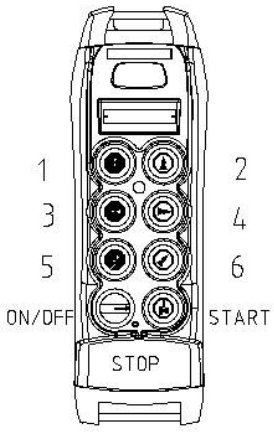
8.3 - BASE CHANNEL FREQUENCY CHANGE

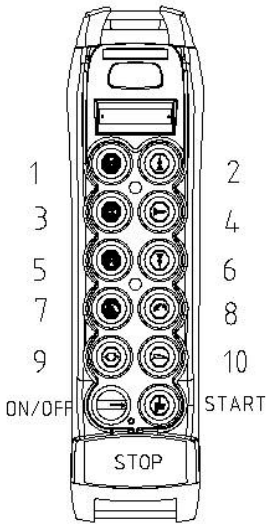
The change of frequency is made via commands that in normal work mode will operate or move the machine. It is very important to follow the programming sequence rigidly, as described below to avoid any movements of the machine.

ENTERING PROGRAMATION MODE

In order to enter the progamation mode the following procedure must be followed:

- Situate yourself in close proximity to the receiver.
- Turn the key to the on position and push in the pull out the red stop. Girar la llave a la posición de contacto.
- Press the pushbutton (1) into the second speed and then push the Start pushbutton and hold both for 2 seconds. During this time the LED will pulse red.
- When entering the progamation mode, the LED of the transmitter will flash orange for a few moments. After a short pause, the LED will indicate the Base Channel that is being used by pulses of green or red in the following manner:
- tens by green colour pulses.
- units by red colour pulses.
- Thus for example, channel 42 would be indicated by means of 4 green pulses, followed by 2 red pulses.
- Next, the LED will again turn orange and the transmitter is now ready to await the introduction of new data. At this point if you wish to leave the progamation mode, simply press the STOP.





PROGRAMMING A NEW BASE CHANNEL

- Once the Base Channel indication is completed and the LED is blinking orange, you may enter a new channel from the permitted list (to see attach), by means of pressing the pushbutton (1) which will give tens and pushbutton (2) the units. Each pulsation is signalized by the LED by means of an orange blink.
- A few moments after last pulsation, the verification of the new channel is signalized by means of the LED as described in the previous point. The LED will then blink orange to indicate that the new channel has been sent to the receiver. When this signal transmission is completed the LED will return to the orange colour.
- If the programming of the new Base Channel has been incorrect then try the process again.
- If the new channel programming has been successful then press the STOP. When re-starting the transmitter the newly selected Base Channel will commence. The Working Channel will coincide with the Base Channel.
- If you try to select a Base Channel that is not included within the permitted range, then the LED will flash red.
- If the Base Channel change has made with a range control system in place, then the receiver will locate the new frequency by entering into a temporary TRACKING mode; once the new channel is located this will be memorised and will then pass to OPERATION mode.

8.4 - WORKING CHANNEL FREQUENCY CHANGE.

Sometimes the transmitters have the possibility of changing the Working Channel when in the OPERATION mode to combat occasional interferences. There are two ways to change this channel which are defined in EEPROM. These are as follows:

CHANGE OF CHANNEL PUSHBUTTON: each press of this pushbutton will advance the Working Channel though the frequencies specified in the EC list. When the highest channel on that list is reached then the channel returns again to the Base Channel. Each time the Working Channel is advance the LED will blink green.

START PUSHBUTTON: by keeping this pushbutton pressed for a 2 second duration it will advance the Working Channel this is indicated on the LED by a red flash each time the channel is changed.

ANNEX A: Channel table 433.050 – 434.790 MHz

Channel	MHz		Channel	MHz
01	433,050		36	433,925
02	433,075		37	433,950
03	433,100		38	433,975
04	433,125		39	434,000
05	433,150		40	434,025
06	433,175		41	434,050
07	433,200		42	434,075
08	433,225		43	434,100
09	433,250		44	434,125
10	433,275		45	434,150
11	433,300		46	434,175
12	433,325		47	434,200
13	433,350		48	434,225
14	433,375		49	434,250
15	433,400		50	434,275
16	433,425		51	434,300
17	433,450		52	434,325
18	433,475		53	434,350
19	433,500		54	434,375
20	433,525		55	434,400
21	433,550		56	434,425
22	433,575		57	434,450
23	433,600		58	434,475
24	433,625		59	434,500
25	433,650		60	434,525
26	433,675		61	434,550
27	433,700		62	434,575
28	433,725		63	434,600
29	433,750		64	434,625
30	433,775		65	434,650
31	433,800		66	434,675
32	433,825		67	434,700
33	433,850		68	434,725
34	433,875		69	434,750
35	433,900		70	434,775

NOTE: The RF power automatically adjusts to the allowed levels as follows:

- Channels 1 to 40: 1 mW
- Channels 41 to 70: 10 mW

ANNEX B: Channel table 869.70625 – 869.9 MHz

Channel	MHz
1	869.70625
3	869.73125
5	869.75625
7	869.78125
9	869.80625
11	869.83125
13	869.85625
15	869.88125
17	869.90625
19	869.93125
21	869.95625
23	869.98125

ANNEX C: Channel table 914.150 – 915.875 MHz

Channel	MHz		Channel	MHz
1	914.150		36	915.025
2	914.175		37	915.050
3	914.200		38	915.075
4	914.225		39	915.100
5	914.250		40	915.125
6	914.275		41	915.150
7	914.300		42	915.175
8	914.325		43	915.200
9	914.350		44	915.225
10	914.375		45	915.250
11	914.400		46	915.275
12	914.425		47	915.300
13	914.450		48	915.325
14	914.475		49	915.350
15	914.500		50	915.375
16	914.525		51	915.400
17	914.550		52	915.425
18	914.575		53	915.450
19	914.600		54	915.475
20	914.625		55	915.500
21	914.650		56	915.525
22	914.675		57	915.550
23	914.700		58	915.575
24	914.725		59	915.600
25	914.750		60	915.625
26	914.775		61	915.650
27	914.800		62	915.675
28	914.825		63	915.700
29	914.850		64	915.725
30	914.875		65	915.750
31	914.900		66	915.775
32	914.925		67	915.800
33	914.950		68	915.825
34	914.975		69	915.850
35	915.000		70	915.875

9.- CAN OPEN INTERFACE

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CANopen INTERFACE

TM70

9.1 - INTRODUCTION

The TM70 system with CANopen interface is integrated in CANopen networks where it will work in slave mode. It handles the Bus the state of the Pushbuttons of the TM70 transmitter, such that any external device can react consequently.

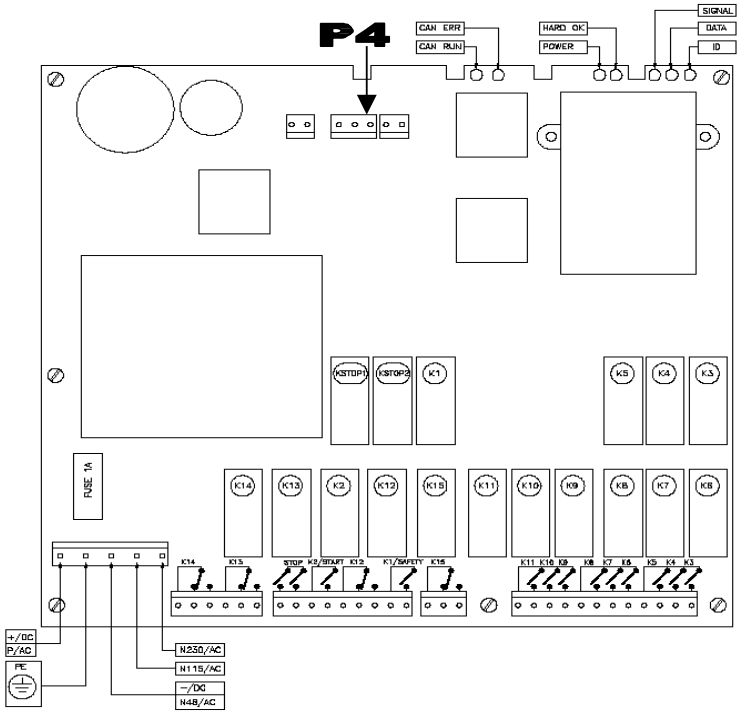
The functionality of the system is according the CiA DS-301 v4.0.2. specification. The implemented profile is described in CiA DS-401 v2.1 (Input/Output standard), where the pushbutton manoeuvres are considered as digital inputs.

The implemented characteristics are:

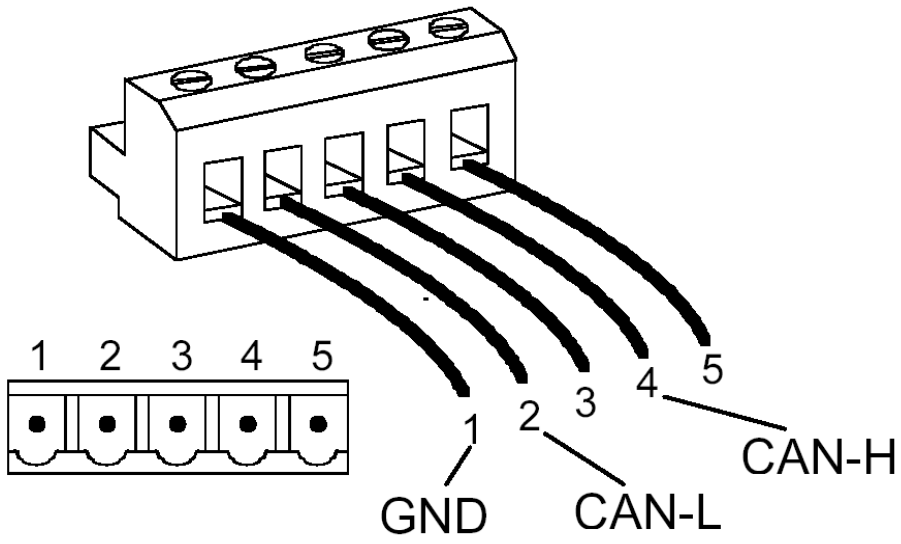
- NMT Functioning: slave.
- NodeID: EEPROM configurable, from 1 to 127.
- Baud rate: EEPROM configurable. Supported speeds: 10, 20, 50, 100, 125, 250, 500, 800 and 1000 Kbps.
- Error control: it can work “Heartbeat” as well as “Node/life guarding”. EEPROM configurable.
- Number of PDO’s: 1 TPDO (manoeuvres state).
- EEPROM parameters recording: not supported.

9.2 - CAN BUS CONNECTION

In order to connect the CAN bus to the LR72 pcb, it contains a 5 poles connector (P4).



The LED signalling is the one recommended by the CiA (CAN in Automation) Organisation in its document DR-303-1:



Bus Termination

Next to the connector, there is one jumper that allows to connect/disconnect the bus termination. It is important for a correct bus operation that bus terminations are connected in both ends, and disconnected in the intermediate nodes.

9.3 - DATA DICTIONARY

The dictionary objects supported by the TM70 are:

1000: DEVICE TYPE
1001: ERROR REGISTER
1002: STATUS REGISTER
1003: PREDEFINED ERROR FIELD
1003.0: number of errors
1003.x: standard error field
1005: COB-ID SYNC
1006: COMMUNICATION CYCLE PERIOD
1007: SYNCHRONOUS WINDOW LENGTH
1008: MANUFACTURER DEVICE NAME
1009: MANUFACTURER HARDWARE VERSION
100A: MANUFACTURER SOFTWARE VERSION
100C: GUARD TIME

100D: LIFE TIME FACTOR
1014: COB-ID EMCY
1015: INHIBIT TIME EMERGENCY
1017: PRODUCER HEARTBEAT TIME
1018: IDENTITY OBJECT
1018.0: number of entries
1018.1: Vendor ID
1018.2: Product Code
1018.3: Revision Number
1018.4: Serial number
1800: TRANSMIT PDO COMMUNICATION PARAMETER
1800.0: number of entries
1800.1: COB-ID
1800.2: Transmission type
1800.3: Inhibit time
1800.4: Event timer
1A00: TRANSMIT PDO MAPPING PARAMETER
1A00.0: number of entries
1A00.1: PDO mapping entry
1A00.2: PDO mapping entry
1A00.3: PDO mapping entry
1A00.4: PDO mapping entry
6000: DIGITAL INPUT 8 BITS
6000.0: number of entries
6000.1: start and stop buttons (start1, start2, stop)
6000.2: buttons 1-4 (M1-M8)
6000.3: buttons 5-8 (M9-M16)
6000.4: buttons 9, 10 and auxiliary inputs (M17-M20, A1, A2)

9.4 - PDO

The system is provided with a 4 byte configured transmission PDO:

1st byte	2nd byte	3rd byte	4th byte
Object 6000.1	Object 6000.2	Object 6000.3	Object 6000.4
Start1	M1	M9	M17
Start2	M2	M10	M18
Stop	M3	M11	M19
0	M4	M12	M20
0	M5	M13	A1
0	M6	M14	A2
0	M7	M15	0
0	M8	M16	0

The PDO transmission is configured by default as “event driven”, this is, it is sent every time there is a change on any input.

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9.5 - SIGNALLING

The receiver is furnished with two signalling LEDs, controlled according to CiA DR-303-3 recommendation:

CAN-RUN (green): indicates the system state inside the CANopen machine state:

- Blinking every 200 ms. In preoperational state.
- Solid green permanently in operational state.
- One blink every second in stop state.

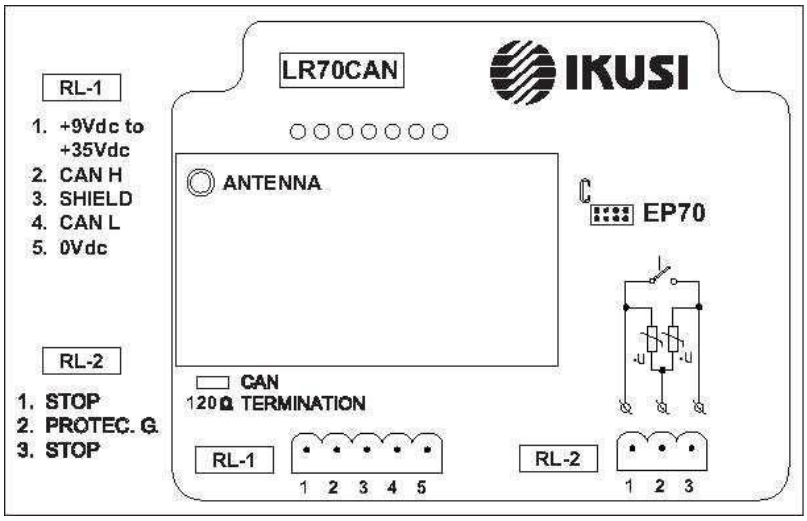
CAN-ERR (red): indicates error if switched on; in normal conditions it must be switched off.

9.6 - TM70 CAN RECEIVERS

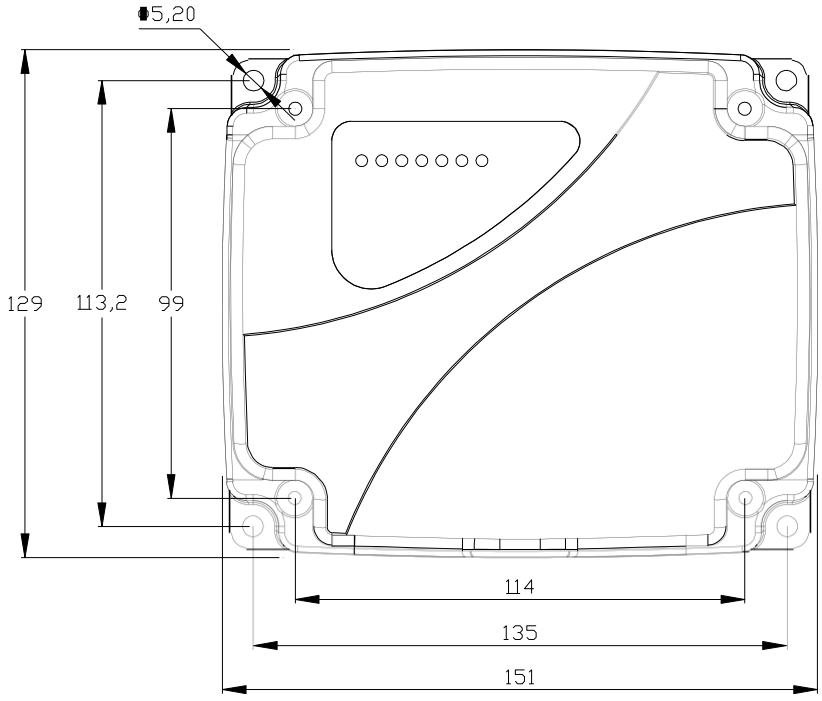
9.6.1 - Ref. 3302626 70GR902 RX-RCANNOCE / TECHNICAL SPECIFICATIONS:

70GR902 RX-RCANNOCE Ref. 3302626	Specifications
Available frecuencies (ISM bands)	915MHz (FCC certified)
Power supply / Maximum consumption	9-35v DC / 5W maximum
Inputs / Outputs interface	CAN:Standard CAN Open protocol 401 (CIA DS401)
Ingress protection	IP67 / NEMA-6
Antenna	External: NEARSON S325TR-015 or equivalent
Working frequency selection	Automatic: LBT (listen before talking)
Weight	430 gr.
Dimensions	Long = 151mm / Width = 129mm (160mm with PG) / Height = 61mm
EEPROM	Extractable EP70 module
Signaling	MultiLED: 7 external LEDS (6 green + 1 bicoloured) 2 internal LEDS (CAN status: 1 red + 1 green)
Connexions	Fast PLUG-IN plugs and 2 x M16 cable glands 1) Power supply cable gland: M16 / IP67 2) Inputs / Outputs interface cable gland: M16 / IP67
STOP function	Cat. 1 EN-954-1 / 1 STOP relay: 250V / 6A maximum STOP response time = 50 miliseconds
CAN BUS termination (120 Ohm)	ON / OFF jumper (internal)
Passive STOP time	Programmable: 0,5 to 2 seconds (máx)
Input protection	PTC / 0,3A fuse
Output protections (STOP)	VDR in contacts
Operating mode temperatura range	-20ºC / +70ºC (-4ºF / 158ºF)
Storage temperatura (24h)	-25ºC / +75ºC (-13ºF / 167ºF)
Storage temperature –long periods-	-25ºC / +55ºC (-13ºF / 131ºF)
TM70 range supported transmitters	T70/1/2; T70/3/4; T70/5/6; T70/7/8
Available complete systems	Ref. 3302XXX Equipo comp. TM70/X.CAN-C1-915

Connections scheme :



Receiver's dimensions -in milimeters-:



It is also available the option Ref. IKUSI 3302620 "Fast fixation kit", including a set of 4 magnets and 4 shock absorbers

Maintenance and troubleshooting / LED's signaling

RECEIVER'S LED SIGNALING

LED	*COLOUR*	STATUS	REMARKS	PROPOSED ACTION
POWER	GREEN	Switch On if powered	Power supply OK	Check the power supply
HARDOK	GREEN	Solid green LED if no error detected Blinking during start up process	Receiver hardware OK	OK Please wait to finish the start up process
HARDOK	RED	Solid red LED if one of these errors appears: - Watchdog activated / Oscillator breakdown / wrong ROM checksum - Reset activated Blinking fast : wrong EEPROM checksum / Data corrupted / CAN Bus error	Electronic board hardware breakdown ----------	Replace the electronic board Reprogramme EEPROM
SIGNAL	GREEN	LED Off if no radio signal detected (Squelch)	- LED On and the transmitter switched Off indicates occupied radio channel - LED On and DATA switched Off indicates radio channel occupied by a non IKUSI system	Verify transmitter's radio and battery
DATA	GREEN	LED Off if a wrong frame is received Blinking if receiving good frames	LED Off and SIGNAL LED On: Radio breakdown	Replace radios
ID	GREEN	Blinking if a correct ID is received	Switched Off and DATA LED switched On: no valid ID	If the radio channel is not busy: verify transmitter's selected ID or reset receiver ID
			SIGNAL; DATA and ID LED On, indicates valid frames from the transmitter. Correct link.	OK
RELAY	GREEN	STOP relay activated	----------	----------
ORDER	GREEN	----------	----------	----------

Internal LEDS signaling

CAN-RUN (green): indicates the system state inside the CANopen machine state:

- Blinking every 200 ms. In preoperational state.
- Solid green permanently in operational state.
- One blink every second in stop state.

CAN-ERR (red): indicates error in the field-bus; if switched on; in normal conditions it must be switched off.

10.- “FIRST COME – FIRST SERVED”

“FIRST COME – FIRST SERVED” OPERATION

TM70

TM70 – "FIRST COME – FIRST SERVED" OPERATION

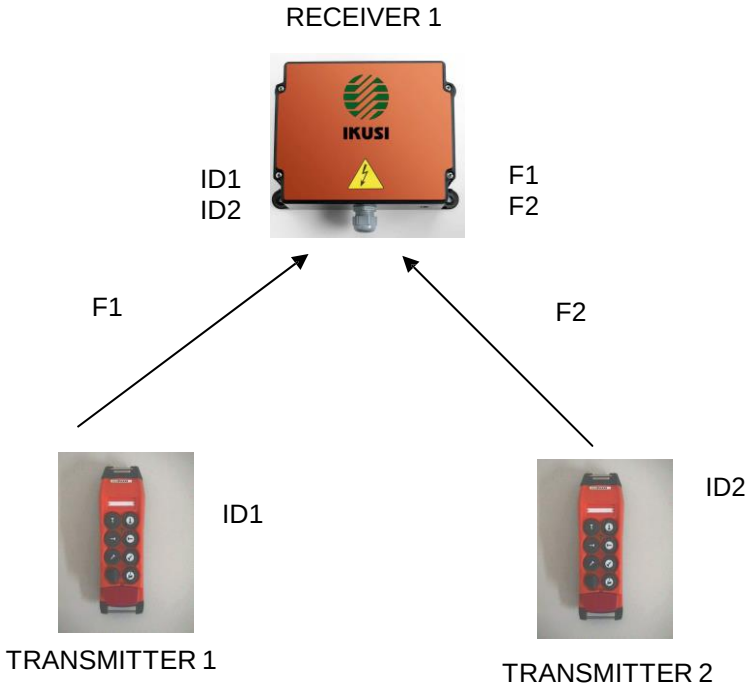
10.1 - INTRODUCTION

This option allows the operation of one crane individually by using two transmitters with two different ID codes, which determine which transmitter is governing the crane at a certain time. For First come – First served applications the receiver is required to scan the radio channels in order to receive radio signals from different transmitters.

The First come – First served mode is defined by EEPROM, and the transmitters do not need to have a selector. The First come – First served mode consists of a receiver which liberates the ID code every time the receiver is switched off, and hence it starts searching for IDs defined in the EEPROM ID code list. The first valid ID code found is selected, and locked on to it until the operator releases the crane by pressing the Stop button. After a time defined in EEPROM (0.1 – 25 seconds, default 4 seconds), the receiver liberates the ID to which it was locked and starts scanning IDs and radio channels. The first transmitter switched on is the First transmitter to hold control of the crane, and it will not let any other transmitter to have control of the crane until the transmitter is switched off.

A First Come – First Served operation with cranes is always delicate, given that the receiver is FREE every time the STOP button is pressed or there is a radio link failure.

10.2 - TWO TRANSMITTER'S SYSTEMS



Transmitters 1 and 2 have two different IDs and transmit in two different radio channels. Once the receiver is switched off by any of the transmitters, after the liberation time defined in the EEPROM, the receiver starts scanning for IDs and radio channels, looking for a frame with the start order pressed.

A First come – First served system can have up to 32 different transmitters governing a single receiver.

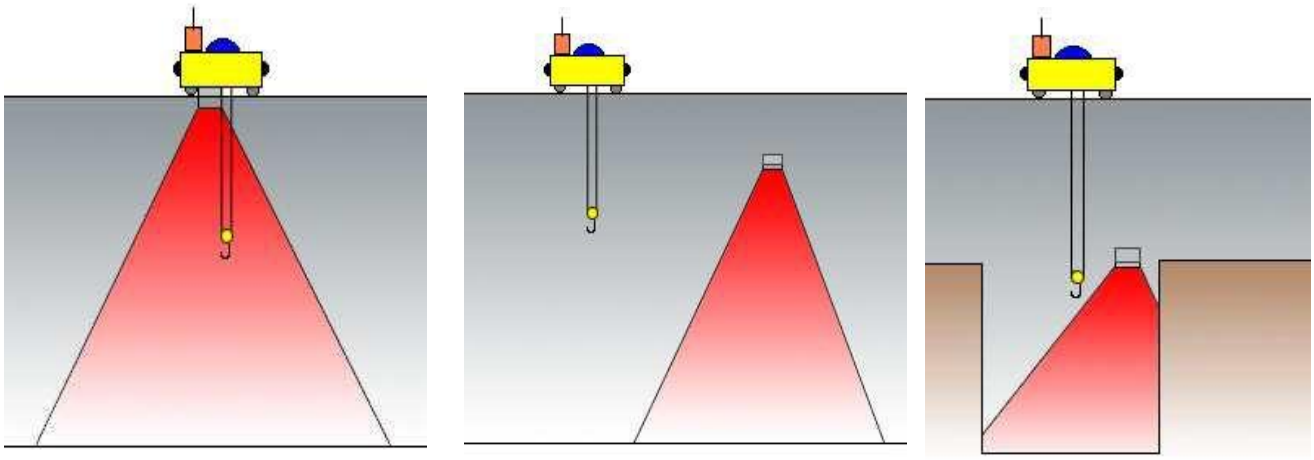
RANGE LIMITER

TM70

11.1 - SYSTEM DESCRIPTION

TM70 radio remote control systems can be equipped with a range limitation option for overhead cranes, through which, the system is able to determine if the transmitter is located outside of a zone, defined as a working area, and deactivates the controls when these situations arise.

The system consists of one or more Infrared transmitters LA70, installed either in fixed positions or on the controlled crane, oriented in such a way that it covers the targeted working zone. In these cases the transmitters of the remote control sets are equipped with a sensor which receives the information coming from the LA70 transmitter. This information is analysed by transmitter microprocessor, which, in this way knows when the operator has left the working area. Consequently, outputs are deactivated.



Application examples:

11.2 - INFRARED SENSOR

As explained in the above, the sensor element is located in the remote control transmitter and its function is to receive the infrared information coming from the LA70 transmitter. The location of this sensor is the following:

The transmitter microprocessor receives the information from the sensor and checks the identity of the crane. As soon as the sensor stops receiving the signal coming from the crane, the transmitter LED, which was green, begins to flash in red, (in case of belly box transmitters, a buzzer also sounds), in order to let the operator know that he has moved too far away. If this situation lasts longer than 4

seconds, all the active commands are cancelled, although communication is maintained with the receiver. In this way the main contactor and the selection orders are maintained.

In order to return to the operating mode, all the worker has to do is move back into the working zone. Movement orders must be disabled in order to restart movement. Once the transmitter enters the working area, movement orders will not be ready to be used unless they have gone to zero. This is to make movements start in first speed. If the remote control is provided with a Display, whenever the transmitter is out of range, the message “Out of Range” will be displayed.

The remote control has got 4 modes of operation defined in the EEPROM:

1.- Range Limiter only at start up (Electronic Key): In order to make the transmitter work, it is necessary that the transmitter is inside the starting zone, defined by the position of the infrared transmitter.

2.- Range Limiter only in operation: The transmitter can be started anywhere, but the movement orders will not work until the transmitter is inside the working zone.

3.- Range Limiter at startup and operation: The transmitter in order to work must be inside the working zone always.

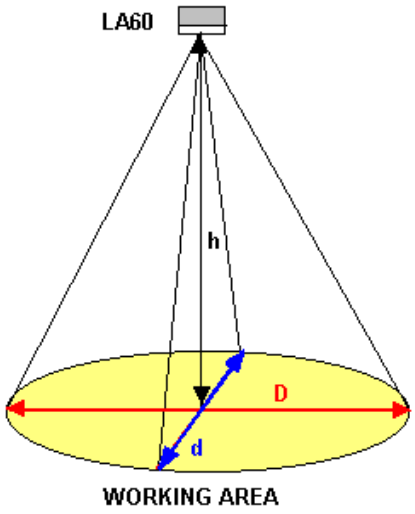
4.- Range Limiter only as an output Relay: This functionality makes the transmitter not to show In range or Out of range situation in the transmitter itself. It will not mask any order. The information will be sent to the receiver in order to process the information as an output relay or a condition to the relay table.

11.3 - INFRARED TRANSMITTER

This is the element installed in the crane, which generates the infrared modulated radiation with an identity code, which permits the sensor its identification.

Emission angle in long travel direction is wider than those of cross travel direction. In this way, the working area covered by a transmitter is similar in shape to an ellipse, whose dimensions depend on the height of the bridge over the ground. Approximately, the diagonals of the ellipse according to the height are the following:

h (m)	D (m)	d (m)
6	24	10
8	32	13
10	40	17
12	48	20
14	56	23
16	64	26
18	68	29
20	70	32



In cases in which it is believed that the area covered by one transmitter is not enough, more slave transmitters can be installed.

11.4 - INSTALLATION

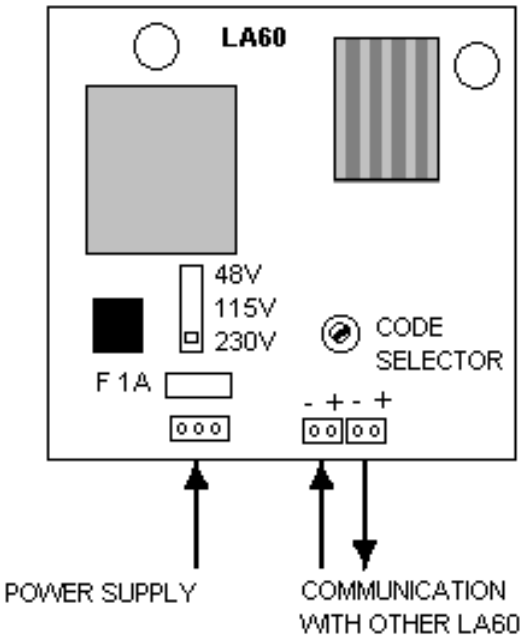
Make sure that the crane is switched off during the assembly operation. Clear the work area and use security clothing.

Check the power supply and disconnect the power supply to the crane.

Do not forget to connect the earth cable.

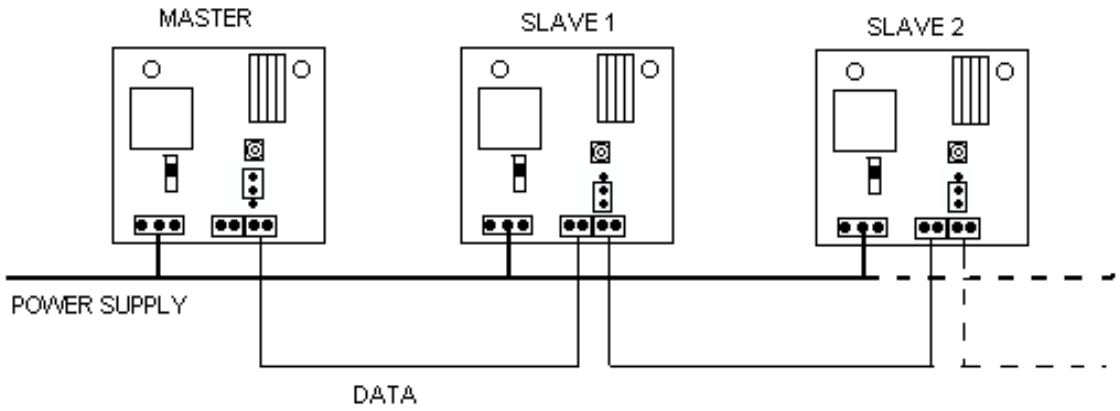
Use flame resistant cables for the connections.

- Find a suitable place for the installation of the infrared transmitter, away from elements, which could generate intense electrical disturbances and obstacles to the transmission of light.
- Choose the correct power supply and connect it.
- Fit the jumper selector in master position.
- Select the code programmed in the EEPROM memory of the transmitter.



In cases in which the area covered by a transmitter is not sufficient, other LA70 transmitters can be connected in series, programmed as slaves in the selector. In this case the code emitted corresponds with the selector in the master transmitter.

The communication connection between transmitters must be done with shielded wires.



11.5 - TECHNICAL CHARACTERISTICS OF THE LA70

Infrared Transmitter

Power supply	48, 115, 230 Vac ± 10%; 50/60 Hz
Operating temperature	-20 a +65ºC
Protection	IP55

“PITCH & CATCH” OPERATION

TM70

TM70 – "PITCH & CATCH" OPERATION

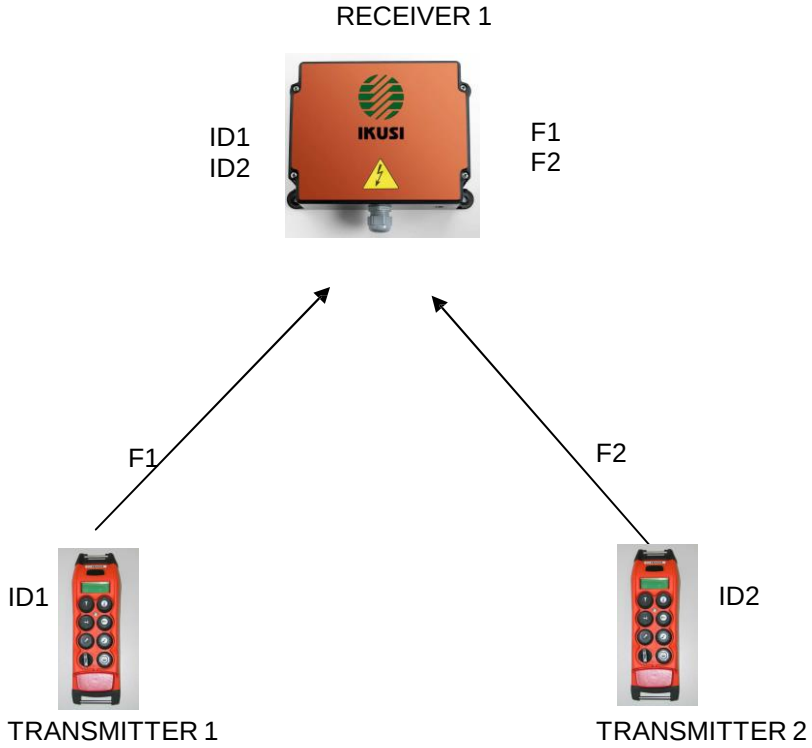
12.1 - INTRODUCTION

This option allows the operation of one crane by two transmitters, through the selection of ID codes, which determine the mode of operation. For this application, the SCAN option for the receivers is required in order to receive transmitters in different channels.

This mode of operation consists of the use of a crane by two different transmitters. The first transmitter governing the crane gets hold of the crane until it as switched off (in principle exactly as the First come – First served mode of operation). In the event of pressing the STOP pushbutton, the other transmitter is switched on and the START order is being pressed, the second transmitter gets hold of the crane without falling the STOP relays. This way, users of the same crane with different transmitters can pass each other the crane without falling the STOP relays. As the START pushbutton must be pressed when transferring the crane if the START relay has got a connected Horn, when the transfer is done an audible sound can be produced.

Pitch & Catch operation is always delicate, given that the receiver is FREE every time the STOP button is pressed or there is a radio link failure.

12.2 - TWO TRANSMITTERS SYSTEMS



Transmitters do not need selectors. The receiver is the one that Frees its ID code.

When a Pitch & Catch operation needs to be performed, the user of the transmitter that wants to Catch the crane must ask the user holding the crane to release the crane. The procedure is the following: The owner of the crane must press the STOP button while the user that wants to Catch the crane must be pressing the START button. The receiver will free the ID code and will SCAN new ID codes and new channels, if in the lapse of time of a passive STOP, it encounters the new ID it will keep on going without falling the STOP relays.

In the event that the transmitter governing the crane stops while the second transmitter is switched off, the system will STOP normally and will be free until one transmitter with a valid ID presses the START button.

When a Pitch & Catch operation is finished, the first transmitter to press START will get hold of the crane.

This mode of operation is personalised in the remote control EEPROM and must be done by IKUSI personnel only.

TANDEM OPERATION

TM70

TM70 – TANDEM OPERATION

13.1 - INTRODUCTION

This option allows the operation of two cranes individually or in tandem by using one transmitter by the selection of ID codes, which determines the mode of operation. For tandem applications both receivers are required to scan the radio channels in order to receive radio signals from different transmitters.

Once a mode has been selected, the access to the selected receiver or receivers will be blocked for other transmitters, until they have not been liberated by the transmitter having the control. This blocking is maintained even in case that the equipment is switched off.

When a selection is made with the transmitter disconnected, the transmitter will not start and shows in the LED that the selection made is not correct with 0,4s red pulses. The transmitter must be switched off and restart it with the selection with which it was switched off.

A Tandem operation with cranes is always delicate.

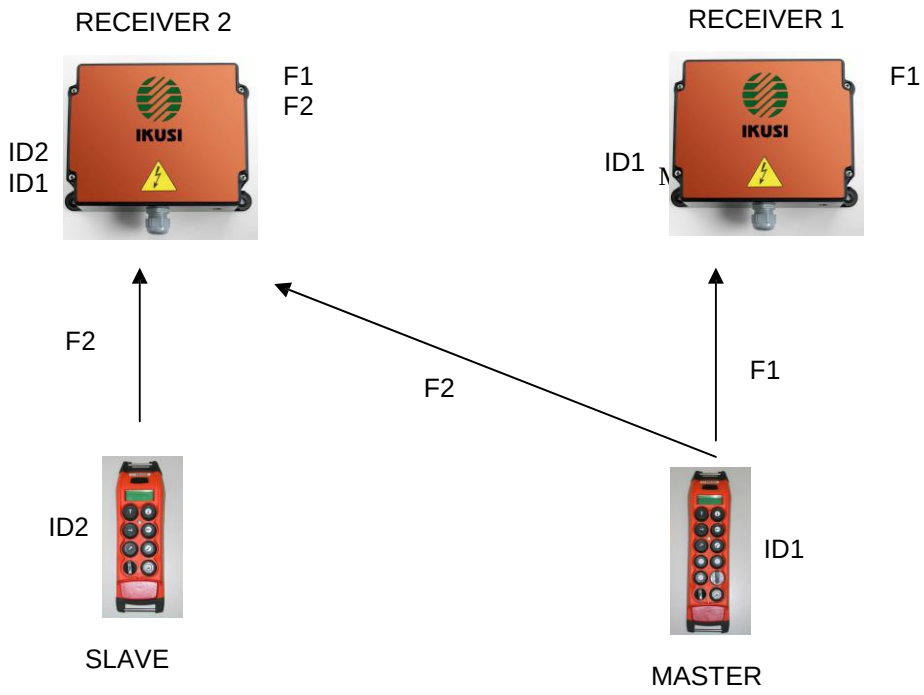
Remember that there are safety devices, (limit switches, anti collision guard systems, etc.), which can affect and stop one of the cranes, while the other continues working.

In the tandem systems with LCD Display option, in the 1st line of the display will be shown the crane 1 name and in the 2nd line the crane 2 name. With the selector switch in position 1+2 both names will be shown.

You can personalize the name of the 2 cranes following the description in ANNEX A in this manual.

The modified name of the crane in the transmitter will not be updated in the receiver EEPROM. In order to do it, please copy the new information located in the transmitter EEPROM into the receiver one.

13.2 - ONE MASTER TRANSMITTER SYSTEMS



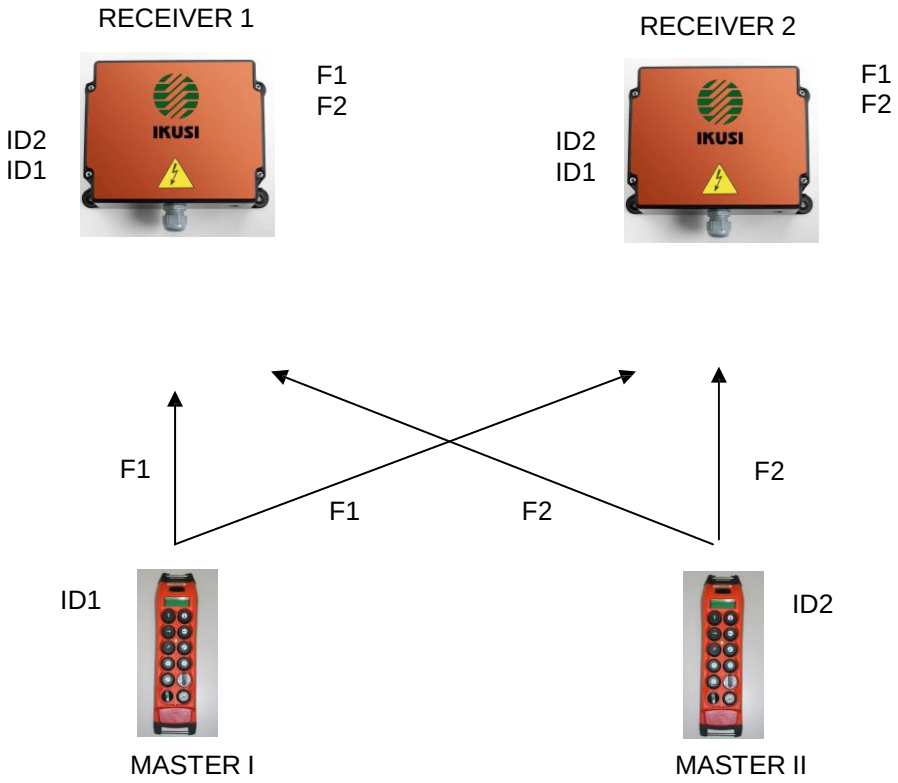
The MASTER transmitter has got a crane selector “1 / 1+2 / 2”, while the SLAVE transmitter has only got a release “R” push button.

When a TANDEM operation is needed, the operator of the MASTER transmitter must need that the SLAVE transmitter operator must release the RECEIVER 2. In order to do it, it has to be pressed simultaneously the release “R” push button and the START button. The transmitter will send to the RECEIVER 2 the liberation order, remaining disconnected and ready to accept a new ID code.

At this stage, the position “1+2” may be selected in the MASTER transmitter and then press the START button until the Green LED is switched on and it will send the new ID code. Both receivers, 1 and 2, will then be started and ready to TANDEM operation.

When TANDEM operation has finished, the MASTER transmitter must select position 1 again and press the START button. By doing this, RECEIVER 2 is again ready to be used by the SLAVE transmitter, and the MAESTRO transmitter only controls RECEIVER 1.

13.3 - TWO MASTER TRANSMITTERS SYSTEMS



In the event of push button systems in tandem operation, with two Master transmitters, both of them will have a “1 / 1+2 / 2” selector and a release pushbutton “R”.

When one of the transmitters must work in tandem, the operator must require his workmate the use of the crane. To liberate the crane the operator will have to press “R” and Start simultaneously in his transmitter. The receiver in which, the operator was working will be liberated and ready to accept another ID code within the list, and the transmitter gets disconnected.

Following this, the transmitter that is going to perform the tandem operation, the position “1+2” should be selected and then press the Start button until the green LED light is switched on. Both receivers will be connected with the transmitter.

When the operation has been finalised, the “R” and Start buttons must be pressed simultaneously, to liberate both receivers, and be able to do new operations.

With console transmitters, the function “R” is included in a four step rotary selector “R / 1 / 1+2 / 2”. The way of operation is the same in both cases.

ANALOGUE FEEDBACK CALIBRATION

TM70

TM70 – ANALOGUE FEEDBACK CALIBRATION

14.1 - INTRODUCTION

Systems with analogue feedback need to have the options Display and Analogue Feedback.

Systems with analogue feedback need at startup the calibration of the analogue input by the distributor or the user. The following steps need to be done:

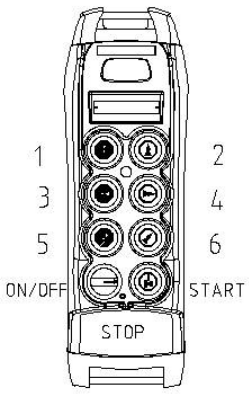
14.2 - CALIBRATION OF THE ANALOGUE FEEDBACK WITH LCD DISPLAY

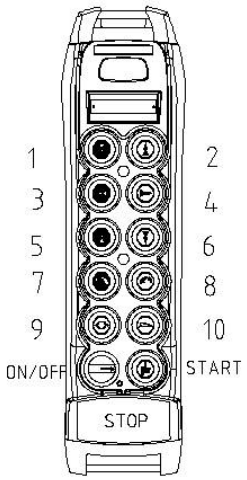
Transmitters with display option, allow the operator the calibration of the analogue input through the edition of a three digit value plus a comma and a measurement unit up to three characters.

The modified feedback calibration data will not be updated in the receiver EEPROM. In order to do it, please copy the new information located in the transmitter EEPROM into the receiver one.

At the remote control start up the Calibration must be done as follows:

1. Insert a fully charged battery and turn ON the contact key.
2. Push and Pull the STOP pushbutton. An orange blink will be seen on the LED followed by green pulses.
3. Place a known load on the crane in order to introduce the First value in Calibration mode.
4. Switch off the remote control and start the system entering in CALIBRATION mode. In order to do so, it is necessary to do the following:
5. Press push button number 4 up to second speed and press START. Keep both pushbuttons pushed for a couple of seconds until it appears on the display CONFIG mode.
6. Press the push button number 4 to go inside the MENU.
7. To move through the menu, use pushbuttons 1 & 2 until CALIBRATION menu is reached.
8. Press pushbutton 4.





9. Once we are in CALIBRATION mode, we enter a submenu where we can select the following pressing pushbuttons 1 & 2: VALUE 1, VALUE 2, UNITS. Pressing pushbutton 4 we enter the selected menu.
   - Pushbutton 1: To move through the character list in a descending order.
   - Pushbutton 2: To move through the character list in an ascending order.
   - Pushbutton 3: To return to the previous character on the display.
   - Pushbutton 4: To validate the edited character and move to the next character.
10. Once the corresponding value to the suspending load has been assigned, the value in the display will be of three digits plus a comma. Units must be edited such that the value represented and the units are coherent. Validate the value inserted pressing START. VALUE 1 will be memorised.
11. Push pushbutton 1 to return to the previous menu in order to edit the UNITS. UNITS must have no more than three characters per file -> 3+3.
12. Press STOP and restart the crane again. Replace the load with another known load.
13. Repeat the process again (steps 4 to 8) selecting VALUE 2 in the CALIBRATION menu.
14. Once finished the feedback calibration process, the system will be calibrated.

At this point the system is ready to work normally. Until calibration is performed, data appearing in the display will be inconsistent.

Calibration generates a linear interpolation of the possible values. This means that it can be used with all systems that generate a linear analogue outputs. For non linear systems the interpolation will not produce a correct display value. Calibration allows to obtain negative values.

Example of calibration of a load cell:

Enter into the calibration mode and introduce the value corresponding to the hook without load (1st value).

Validate the value pressing START. Switch off the transmitter.

Start the system again and raise a known load.

Switch off the transmitter and enter again to the calibration mode for the edition of the 2nd value.

Press START to validate the value.

Press pushbutton 1 to edit the units.

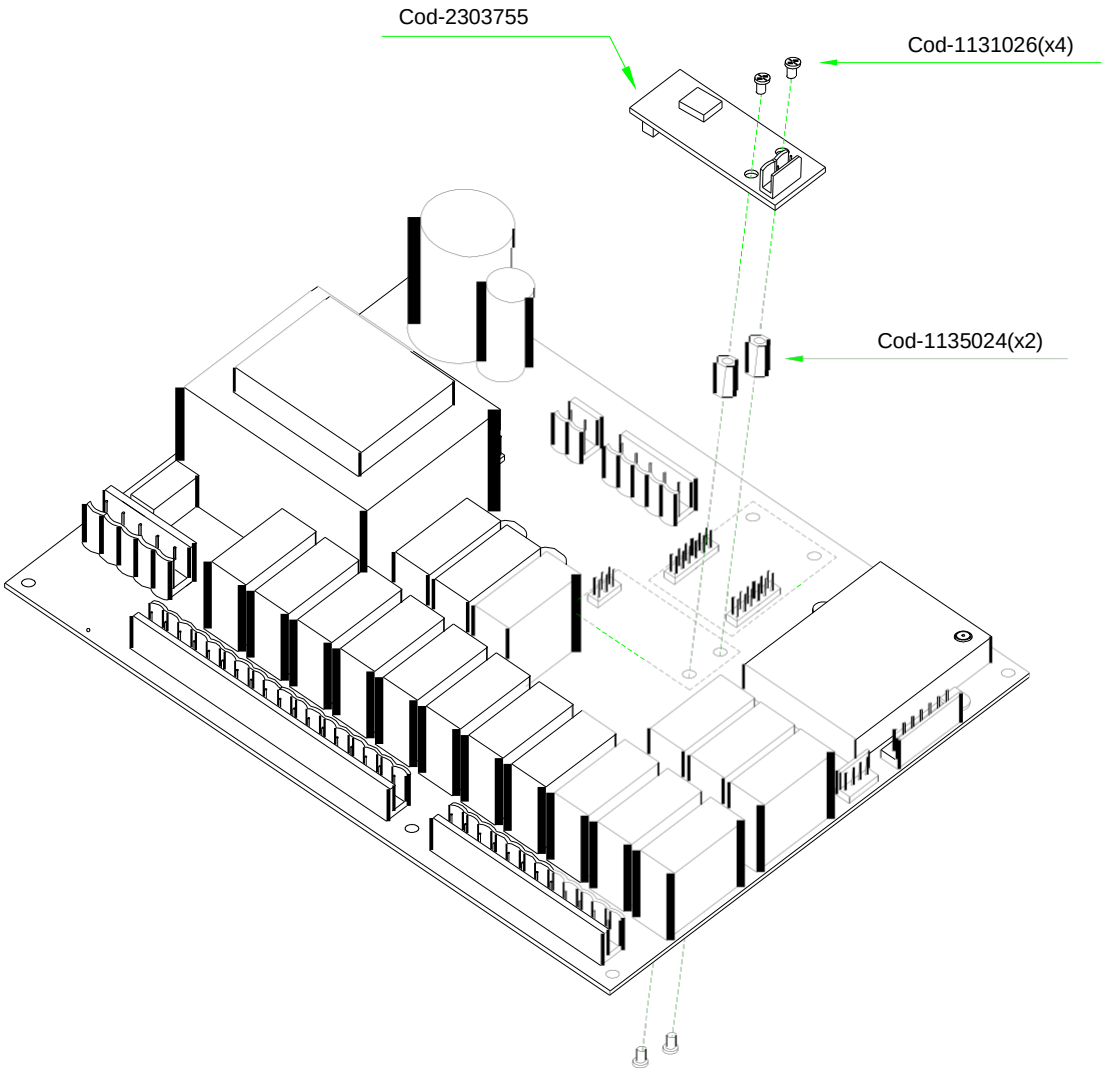
Press START to validate the units.

Switch off the transmitter.

The equipment is already ready to work normally.

14.3- LR71/72 and 0-10V ASSEMBLY

IN0-10V (Ref. 2303755)



15.- IN0450P OPTION

IN0450P Option

TM70

15.1 - INTRODUCTION and FUNCTIONAL DESCRIPTION

The IN0450P electronic card can be conected to the LR70, 0-3V analogue input and it allows to measure the frequency coming from a pulse generator operating between 0 - 450 Hz range.

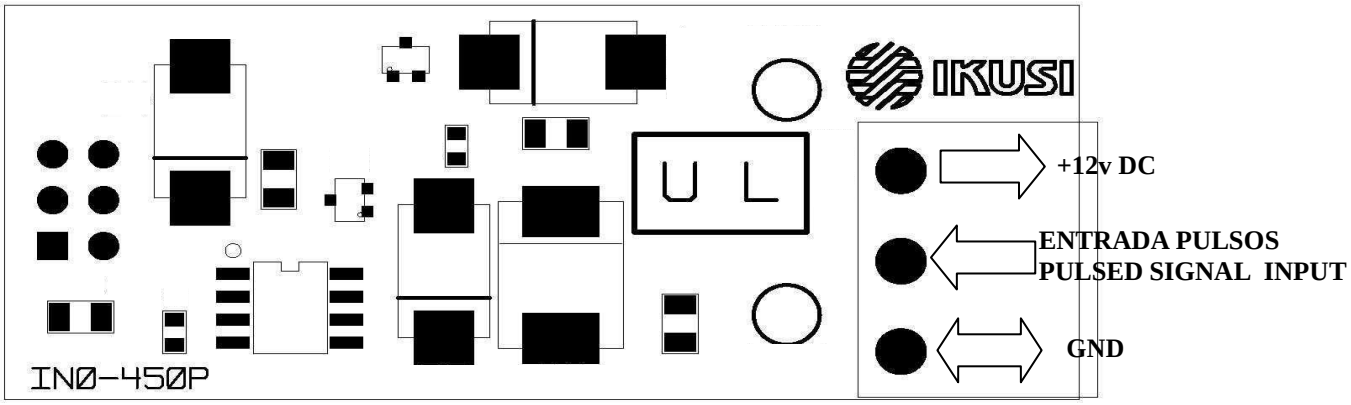
This electronic card is a frequency voltage converter and it can be used, for example, as an interface between an anemometer (sensor) that provides a pulsed signal, in order to show in the transmitter's display the speed of the wind, in real time mode, using the feedback option.

The card supplies a +12v DC voltage output to power the sensor.

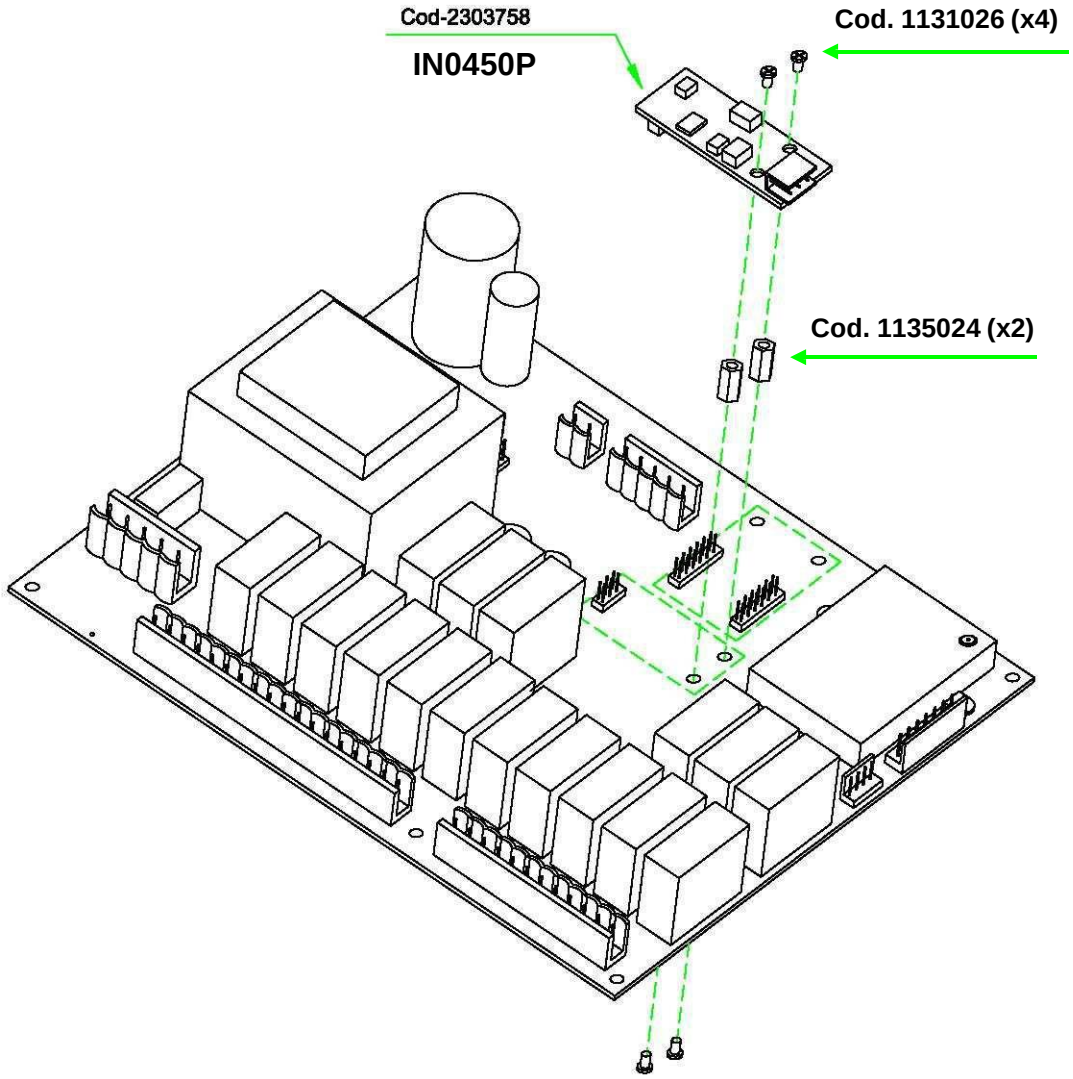
Technical characteristics:

- Maximum resolution: 8 bits.
- Input frequency range: 0 – 450 Hz.
- Galvanically isolated from the main logic board (LR70).
- Operating temperature range: –20ºC a +70ºC

Signals and connections block diagram:



15.2 - IN0450P and LR70 ASSEMBLY



16.- IN4D OPTION

IN4D OPTION

TM70

16.1 - INTRODUCTION AND FUNCTIONAL DESCRIPTION

The IN4D electronic card provides 4 digital inputs interface to the TM70 receiver. This card can be connected as an expansion -as single card- in the LR70 receiver card through P16 connector. The IN4D card can also be used as a multi-digital input using the INCAN option (multiple IN4D inputs option), as an alternative to the single one.

The IN4D card is basically a four digital to analogue signal converter. The four digital signals (IN1, IN2, IN3 and IN4) are converted to a 0 to 3 volts analogue value, available in the LR70 (or in the INCAN card). See figure 1.

The four digital inputs, IN1, IN2, IN3 and IN4 must have the following analogue values, in reference to the pin 6 (GND) ; I3 connector:

- 0 to 4V is equivalent to a deactivated state or '0' logic state.
- 8 to 28V is equivalent to an activated state or '1' logic state.

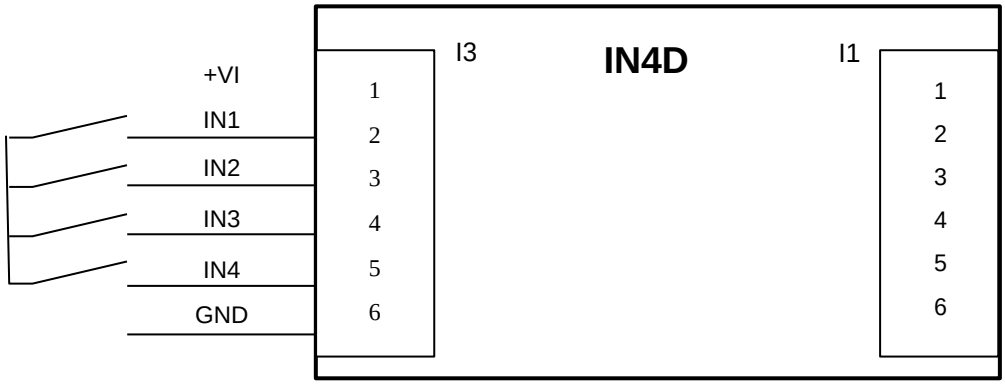


Figure 1

See I3 connector: 1 to 6 pins.

Very important remark: Do not apply higher voltages than 28 volts, in order to prevent card's damage.

If there is no external voltage range available, the card provides through pin number 1 (+VI), a voltage between 12 and 20 volts, to activate the inputs as shown in the figure 2.

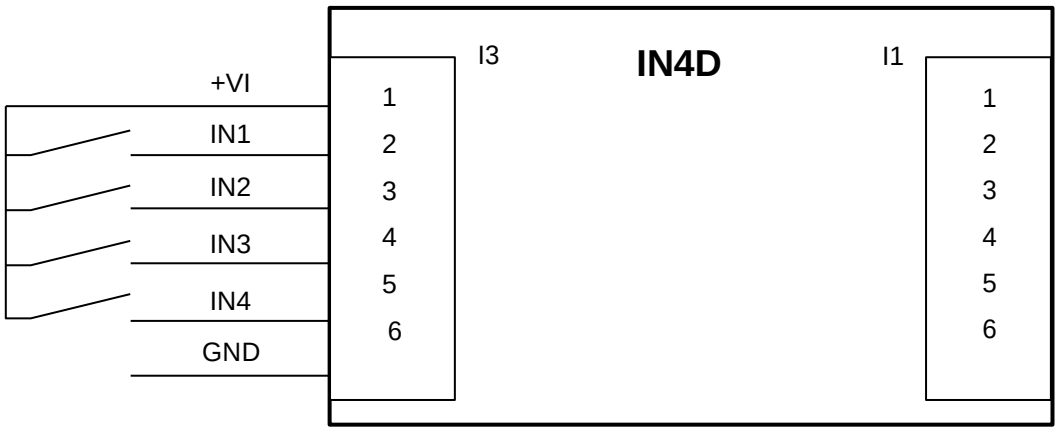


Figure 2

Block diagram of the signals (see figure 3):

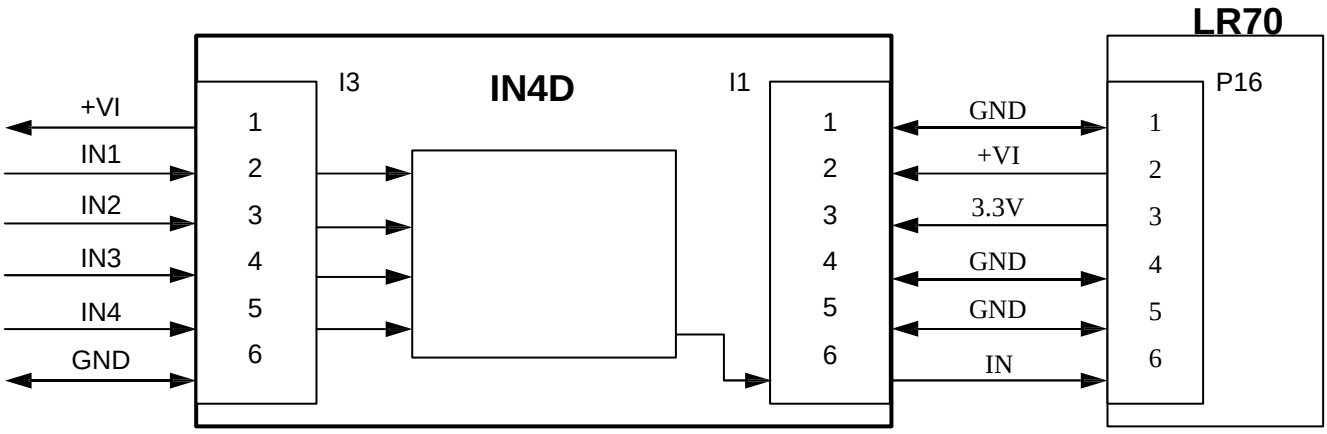


Figure 3

Electronic card top view (see figure 4).

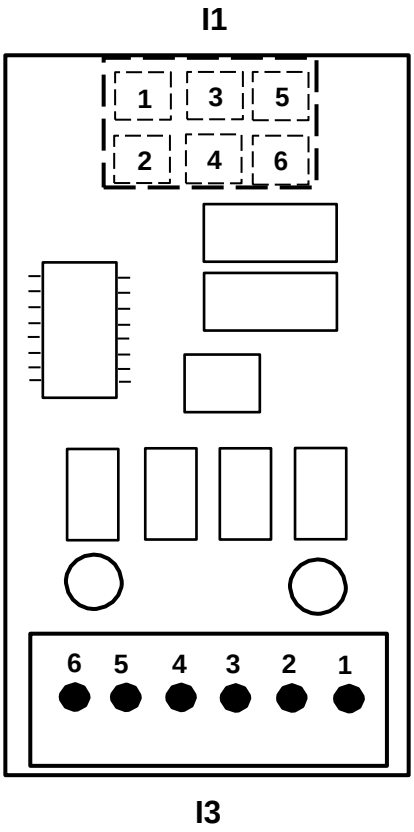
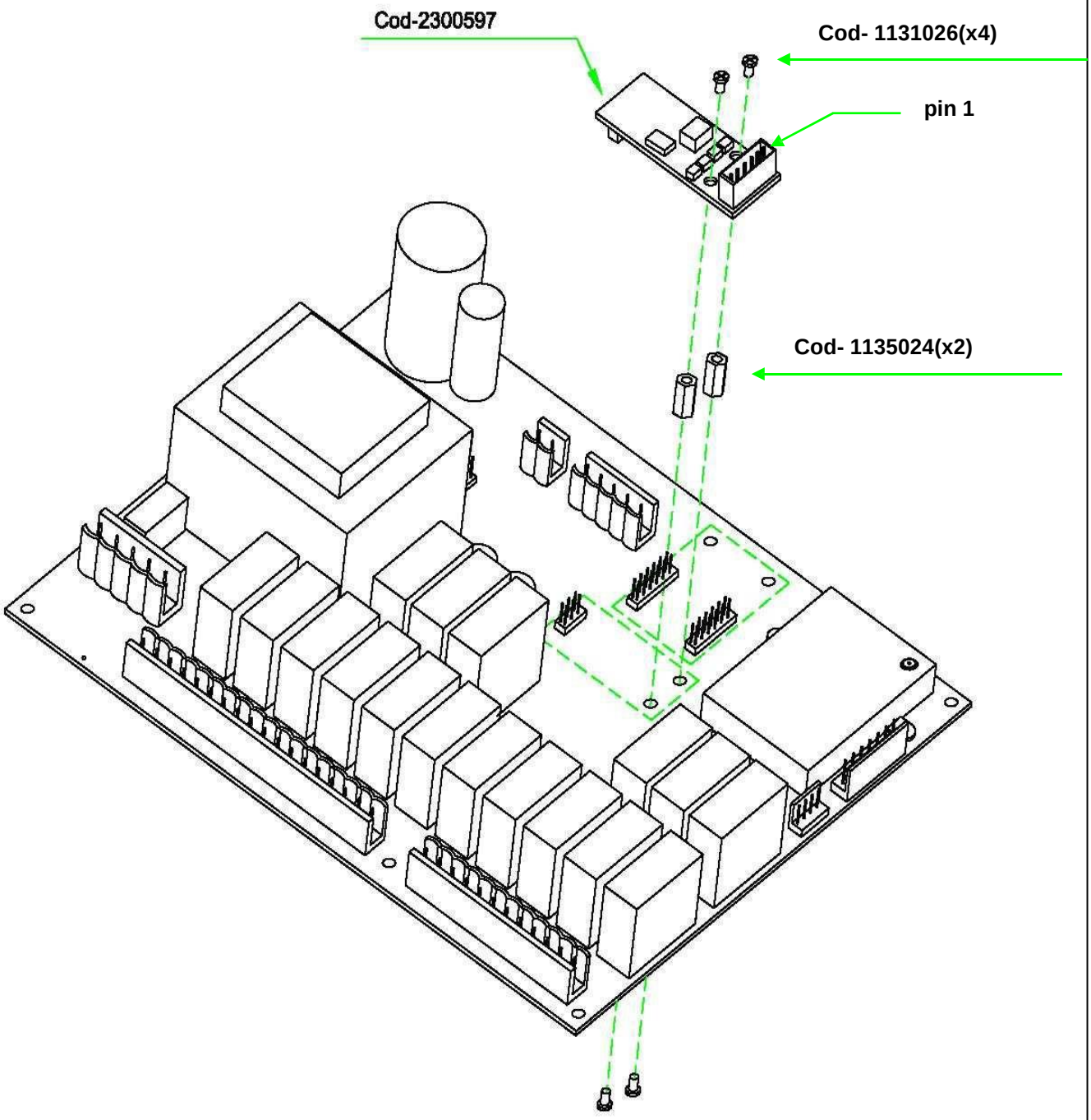


Figure 4

16.2 - IN4D AND LR71/LR72 ASSEMBLY



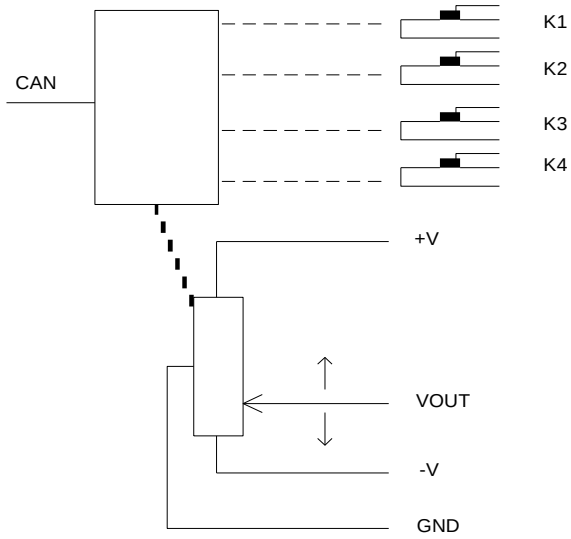
17. - A1P4RCAN OPTION

A1P4RCAN OPTION

TM70

17.1.- INTRODUCTION and FUNCTIONAL DESCRIPTION

The A1P4RCAN CAN expansion module provides to the TM70 receiver, 4 relays output and an analogue output at the same time. The analogue output simulates a digital potentiometer with 64 steps available in each semi-axis of the power supply. See the diagram block below (**size ½ of LR72**):



This CAN expansion provides to the user the following outputs :

An analogue output simulated by a digital potentiometer with 128 steps and galvanically isolated.
Free to use four relays outputs, K1, K2,K3 and K4.

These outputs are controlled by CAN BUS, writing in its addresses CANOpen frames. The CAN address of the electronic card is conformed using the 7 jumpers of P1 connector. Jumper in position 1 corresponds with the first bit of the CAN address. Thus, inserting several bridges it is possible to select different addresses from «1 » until «127» (2^7), maximum.

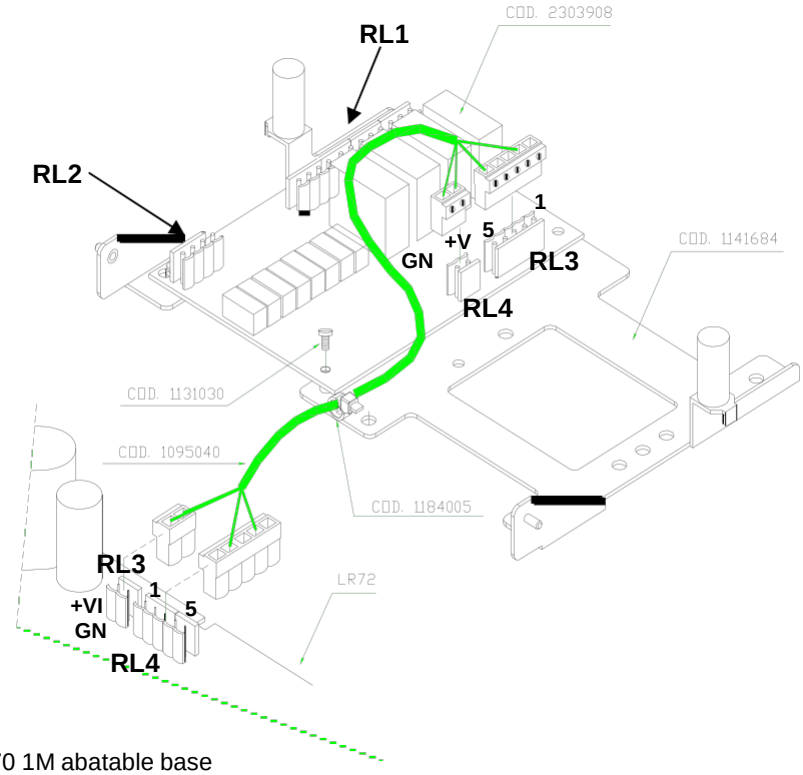
Very important : The address « 0 » is not a valid address ; so the board allways must be fitted with at least one jumper. With one jumper it is possible to configure 7 different addresses.

17.2.- RECEIVER ASSEMBLY and TELE-TEACHING OPTION

LR72 ELECTRICAL CONNECTION

This expansion is connected to the LR72 board using two connectors; 2 pins connector labeled RL4 for power supply 8-30V (+VI and GND); 5 pins connector labeled RL3 for CAN Bus connection with the following signals :

Pin	Name	Function
1	GNDCAN	Ground
2	CANL	CANL bus signal (CANLow signal)
3	SHLCAN	Shielding
4	CANH	CANH bus signal (CANHigh signal)
5	VCAN	Power Supply



Cod. 1141684: TM70 1M abatable base
Cod. 1184005: UNEX 2221-0 clip
Cod. 1095040: CAN RC70 1 expansion cable
Cod. 1131030: M3x6 C/R DIN84 screw
Cod. 2303908: A1P4RCAN electronic board

RELAY OUTPUTS

The following connections are available for each relay: normally open (NO), normally closed (NC) and common, in the RL1 connector as shown in the following table. **Disposition of 4 manoeuvre relays of 250V/8A.**

Pin	Function
1	K1 contact: normally closed
2	K1 common contact
3	K1 contact: normally opened
4	K2 contact: normally closed
5	K2 common contact
6	K2 contact: normally opened
7	K3 contact: normally closed
8	K3 common contact
9	K3 contact: normally opened
10	K4 contact: normally closed
11	K4 common contact
12	K3 contact: normally opened

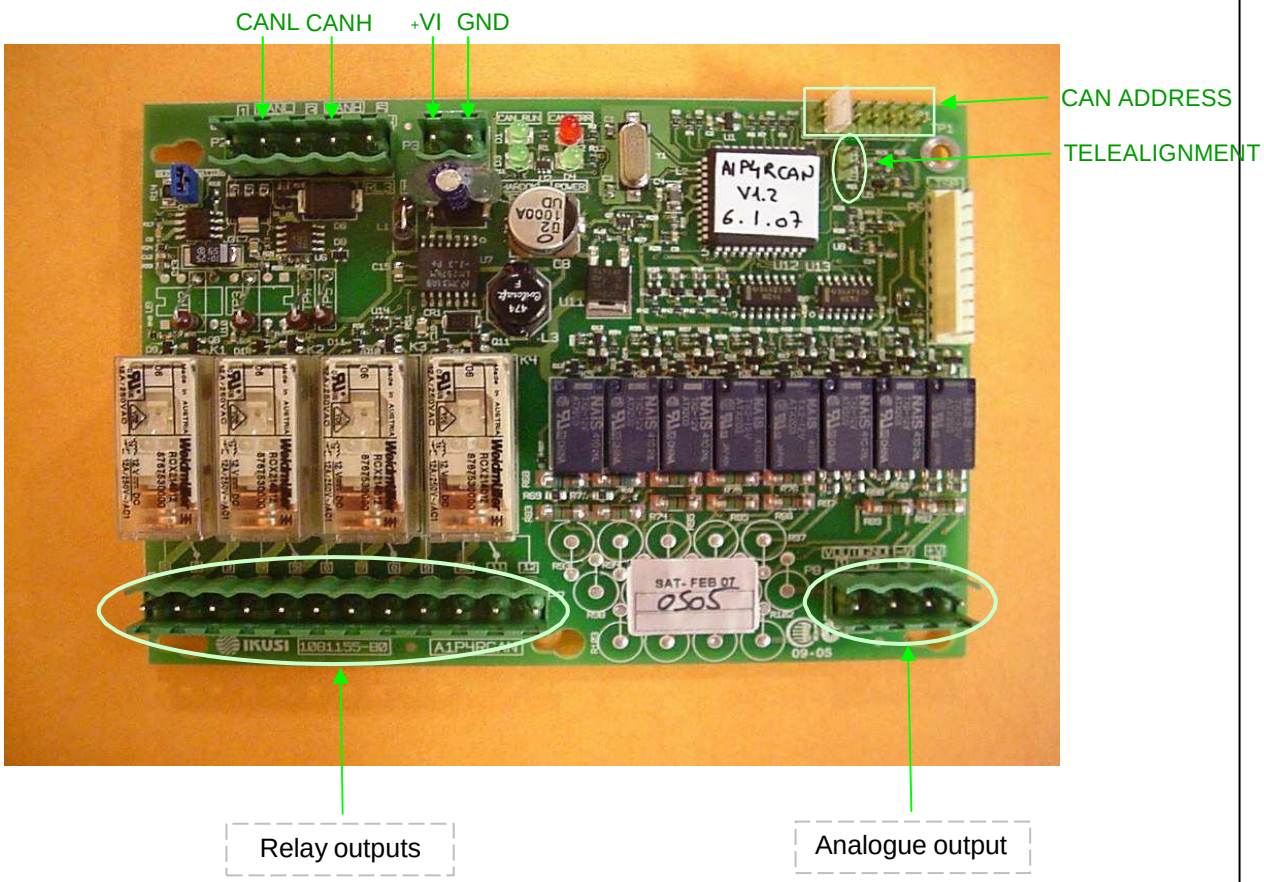
ANALOGUE OUTPUT

The analogue output is connected through RL2 connector with the following signals (Imax=15mA):

Pin	Name	Function
1	VOUT	Analogue Output
2	GND	Potentiometer's middle point
3	-V	Negative power supply (Minimun: -50V)
4	+V	Positive power supply (Maximun: 50V)

TELE-TEACHING (V3.1 OF SOFTWARE OR HIGHER VERSIONS)

Through Tele-Alignment can set the maximum and minimum values, the polarity inversion, acceleration or deceleration ramp and curve type of the analogue output. To change to Tele-Alignment mode is necessary to introduce a bridge in the jumper P5 (see Jumpers configuration). **Only available for TM70 consol box from 3.1 software version or higher.**



18.- A1P4RCAN OPTION

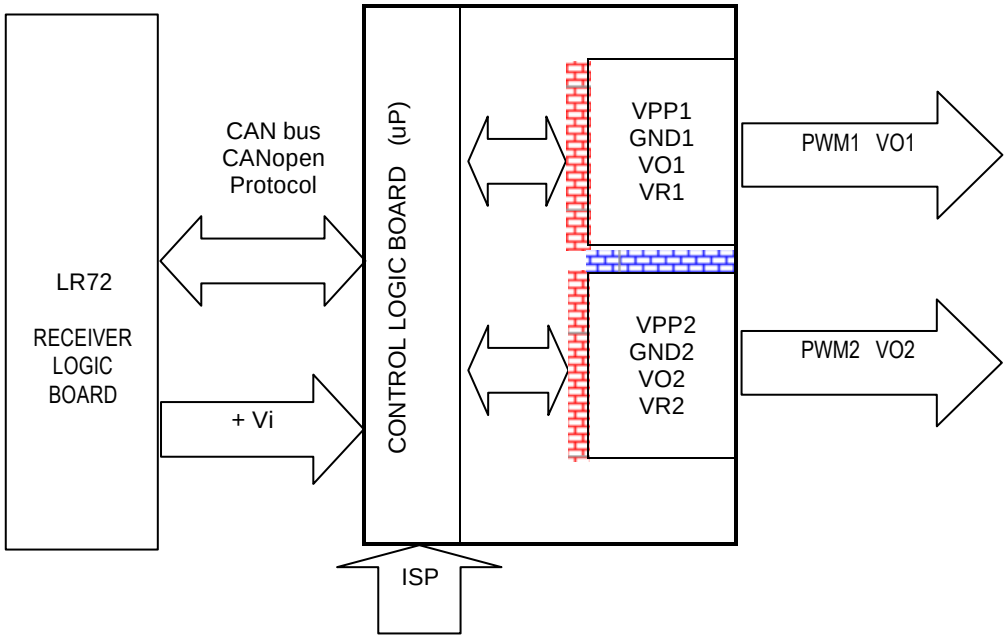
A2ICAN OPTION

TM70

18.1- INTRODUCTION & FUNCTIONAL DESCRIPTION

The A2VCAN electronic board gives to the modular TM70 systems an analogue output in current (PWM), allow the government of electro-hydraulic proportional valves with input reference in current. The electronic board contains two output stages galvanically each other separated and from the control common logic.

A2ICAN



A2ICAN electronic board is an expansion of two analogue outputs controlled by the CANopen interface.

The A2ICAN electronic board implement, for integration into the TM70 system, an own resident software in its microprocessor, that performs the following functions:

Communication with the LR72 electronic board through CANOpen protocol, using the standard profile 401, input/output digital/analogue (CIA DS401 - CANopen Device Profile for Generic I/O Modules).

Generates two analogue outputs in current according to the received instructions and the settings for each output.

There are two types of response curves for each output:

Linear: response of the analogue output proportional to the input

Non-linear: the response of the analogue output is exponentially regarding the input. Variations of the joystick inputs at the beginning of his movement will result in small changes of the output voltage, while the same variations of the joystick input at the end of the movement will result in major changes in the output voltage.

The choice of one or another profile is decided by a customization parameter P (customizable by EEPROM or Tele-Alignment), which uses 0 for linear curve and 1, 2 or 3 for exponential curves from low to high grade.

It also can be programmed exit ramps on rise and/or fall per semiaxis. The form of response of the ramps is under defined output type: linear or nonlinear.

The ramp speed is defined for each semiaxis by a parameter that can take a value between 0 and 15, by default 0. Each of these values corresponds to a ramp time from minimum to maximum value given by the following table:

0 -+ without ramp	4 -+ 0,4 s	8 -+ 1,0 s	12 -+ 2,0 s
1 -+ 0,1 s	5 -+ 0,5 s	9 -+ 1,2 s	13 -+ 2,5 s
2 -+ 0,2 s	6 -+ 0,6 s	10 -+ 1,5 s	14 -+ 3,5 s
3 -+ 0,3 s	7 -+ 0,8 s	11 -+ 1,7 s	15 -+ 5,0 s

Each output is a PWM signal with current feedback in which is possible the control and compensation of the switching frequency and pulse width. It also implements a superimposed "dither" signal on the output, with variable frequency and amplitude, to soften the response of certain hydraulic valves. The "dither" is available only when the switching frequency of the PWM output is 5 kHz:

PWM Frequency range: 33,35,40,45 ... 1275 and 5000 Hz
Dither Frequency range: 33 ... 255 Hz
Dither Amplitude range: 0 ... 50%

Through Tele-Alignment can set the maximum and minimum values, the polarity inversion, acceleration or deceleration ramp and curve type of the analogue output. To change to Tele-Alignment mode is necessary to introduce a bridge in the jumper P6 (see Jumpers configuration). **Only available for TM70 consol box from 3.1 software version or higher.**

Other features of the PWM current outputs:

Power supply range of the expansion 8-30V, and of the outputs 5-35V.
Each output channel has 2 outputs only one of which will be connected, according to the sign of the input. 2 PWM outputs are identical and independent.
The output resolution is 128 steps by semiaxis (256 max – 8 bit), corresponding to step 0 a null output and step 127 to obtained from the permanent exit from the positive supply.
Max current = 5A (each output).
Outputs protected against short-circuit.

18.2- CONNECTIONS & JUMPERS CONFIGURATION

CONNECTIONS WITH THE LR72

The expansion connects to the LR72 electronic board through two connectors, one of 2 pin for power supply (VI + and GND) and the other of 5 pin for the CAN bus with the following signals:

Power connector	
Pin number	Function
GND	Ground
+VI	DC between 8 y 30V

CAN bus connector	
Name	Function
VCAN	Power supply
CANH	CANH pin of the CAN bus
GNDCAN	Ground (Shielding)
CANL	CANL pin of the CAN bus
GNDCAN	Ground

OUTPUTS

Each analogue output has two serial relays that switch the output signal to one of two ways, the direct or the inverse. If not activate any of the relays, both outputs (the direct and inverse) are disconnected.

OUTPUT PWM1

The connections of the output 1 are through 4 pole terminal plug, with the follow pin assignment:

Output 1 connector	
Pin Name	Function
VPP1	Power of channel 1
GND1	Ground of channel 1
VO1	DIRECT analogue PWM output of channel 1
VR1	INVERSE analogue PWM output of channel 1

OUTPUT PWM2

The connections of the output 1 are through 4 pole terminal plug, with the follow pin assignment:

Output 2 connector	
Pin name	Function
VPP2	Power of channel 2
GND2	Ground of channel 2
VO2	DIRECT analogue PWM output of channel 2
VR2	INVERSE analogue PWM output of channel 2

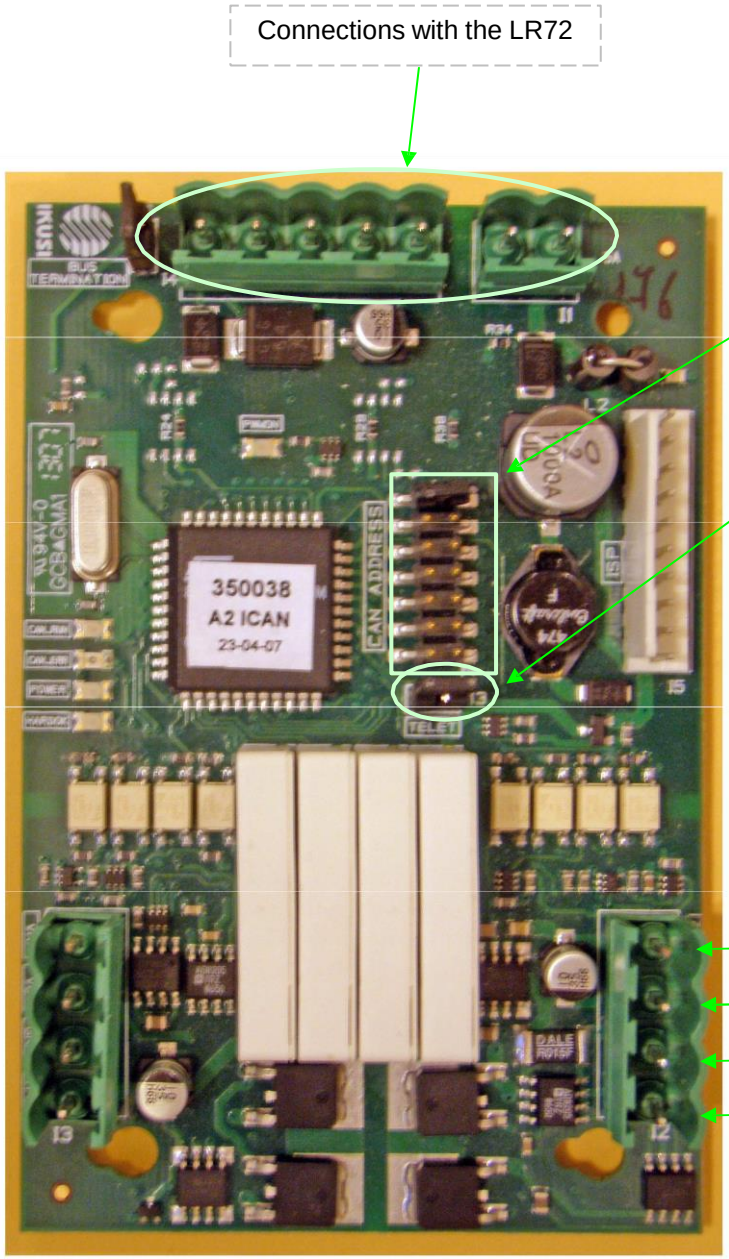
ISP (PROGRAMACION "IN CIRCUIT" / "IN SYSTEM")

The expansion has a connector to record "In-System" (eg. Microprocessor software update). This connector has 10 pins:

ISP connector	
Pin name	Function
ISP2	Input connected to the ground to place the microcontroller in recording mode
TX2	Not used
RX2	Receiving data signal
GND	Ground
RX1	Receiving data signal
TX1	Transmisión data signal
ISP	Not used
VCC	Power supply output at 3,3 V
MRNOT	Reset input, active when it is connected to ground
+VI	Power supply output at 12 V (not stabilized, can vary between 8 y 22 V)

JUMPERS CONFIGURATION

Size ¼ of LR72



19.- A2VCAN OPTION

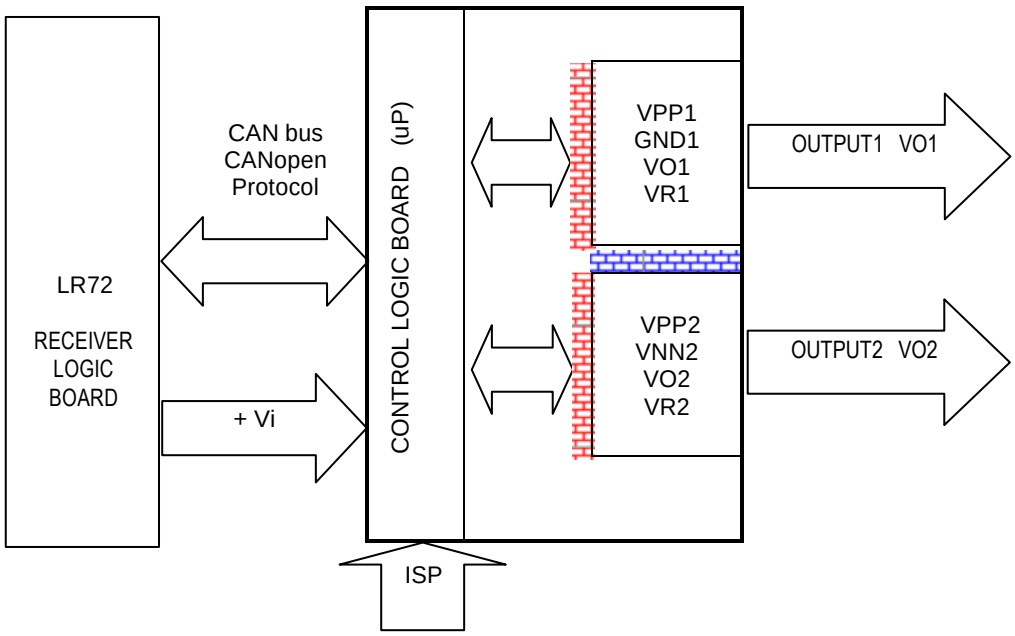
A2VCAN OPTION

TM70

19.1- INTRODUCTION & FUNCTIONAL DESCRIPTION

The A2VCAN electronic board gives to the modular TM70 systems an analogue output in voltage option, allow the government of variable frequency drives with voltage control, electro-hydraulic proportional valves with input reference in voltage, etc. The electronic board contains two output stages galvanically each other separated and from the control common logic.

A2VCAN



A2VCAN electronic board is an expansion of two analogue outputs controlled by the CANopen interface. Can generate two analogue outputs (dependent on supply voltage) with a resolution of 10 bits (1024 steps).

The A2VCAN electronic board implement, for integration into the TM70 system, an own resident software in its microprocessor, that performs the following functions:

Communication with the LR72 electronic board through CANOpen protocol, using the standard profile 401, input/output digital/analogue (CIA DS401 - CANopen Device Profile for Generic I/O Modules).

Generates two analogue outputs in voltage according to the received instructions and the settings for each output.

There are two types of response curves for each output:

Linear: response of the analogue output proportional to the input

Non-linear: the response of the analogue output is exponentially regarding the input. Variations of the joystick inputs at the beginning of his movement will result in small changes of the output voltage, while the same variations of the joystick input at the end of the movement will result in major changes in the output voltage.

The choice of one or another profile is decided by a customization parameter P (customizable by EEPROM or Tele-Alignment), which uses 0 for linear curve and 1, 2 or 3 for exponential curves from low to high grade.

It also can be programmed exit ramps on rise and/or fall per semiaxis. The form of response of the ramps is under defined output type: linear or nonlinear.

The ramp speed is defined for each semiaxis by a parameter that can take a value between 0 and 15, by default 0. Each of these values corresponds to a ramp time from minimum to maximum value given by the following table:

0 -+ without ramp	4 -+ 0,4 s	8 -+ 1,0 s	12 -+ 2,0 s
1 -+ 0,1 s	5 -+ 0,5 s	9 -+ 1,2 s	13 -+ 2,5 s
2 -+ 0,2 s	6 -+ 0,6 s	10 -+ 1,5 s	14 -+ 3,5 s
3 -+ 0,3 s	7 -+ 0,8 s	11 -+ 1,7 s	15 -+ 5,0 s

Through Tele-Alignment can set the maximum and minimum values, the polarity inversion, acceleration or deceleration ramp and curve type of the analogue output. To change to Tele-Alignment mode is necessary to introduce a bridge in the jumper P6 (see Jumpers configuration). **Only available for TM70 consol box from 3.1 software version or higher.**

Other features of the PWM current outputs:

Power supply range of the expansion 8-30V, and of the outputs 5-35V.
Max current = 10 mA (each output).
Outputs protected against short-circuit.

19.2- CONNECTIONS & JUMPERS CONFIGURATION

CONNECTIONS WITH THE LR72

The expansion connects to the LR72 electronic board through two connectors, one of 2 pin for power supply (VI + and GND) and the other of 5 pin for the CAN bus with the following signals:

Power connector	
Pin number	Function
GND	Ground
+VI	DC between 8 y 30V

CAN bus connector	
Name	Function
VCAN	Power supply
CANH	CANH pin of the CAN bus
GNDCAN	Ground
CANL	CANL pin of the CAN bus
GNDCAN	Ground

OUTPUTS

The voltage outputs are generated from PWM pulses, and them filtered result in radiometric tension outputs (dependent on supply voltage). The two outputs are electrically isolated respect to the logic and each other.

The control of relays is done via VREL1 and VREL2 signals. Also, it needs to be activated the common of both relays by VCOMREL signal. When the relays are off, the output voltage VO1 and VO2 are the values of reference voltage VR1 and VR2 connected at each output.

The output values range goes from 0 to 100% of power supplies VPP1 and VPP2 connected to each of the outputs and have a resolution of 10 bits (1024 values).

OUTPUT 1 (VO1)

The connections of the output 1 are through 4 pole terminal plug, with the follow pin assignment:

Output 1 connector	
Pin Name	Function
VPP1	Power of channel 1
GND1	Ground of channel 1
VO1	Analogue output of channel 1
VR1	Zero position signal signal to get through the output 1 when the relay is inactive

OUTPUT 2 (VO2)

The connections of the output 1 are through 4 pole terminal plug, with the follow pin assignment:

Output 2 connector	
Pin name	Function
VPP2	Power of channel 2
GND2	Ground of channel 2
VO2	Analogue output of channel 2
VR2	Zero position signal signal to get through the output 2 when the relay is inactive

ISP (PROGRAMACION "IN CIRCUIT" / "IN SYSTEM")

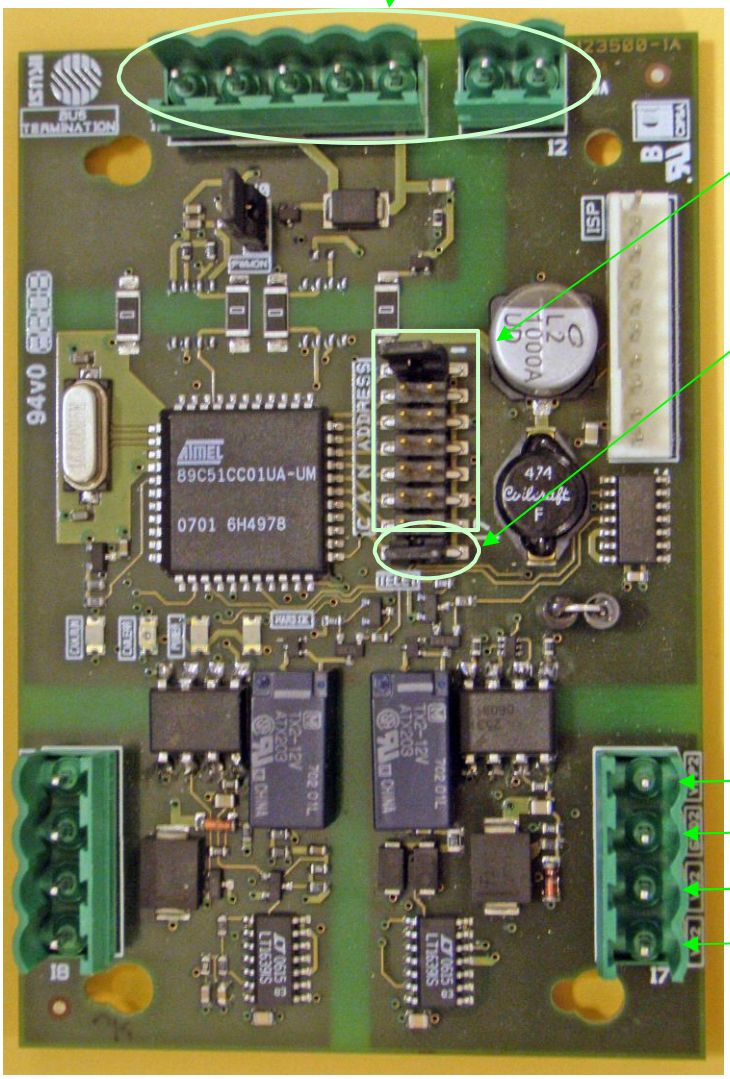
The expansion has a connector to record "In-System" (eg. Microprocessor software update). This connector has 10 pins:

ISP connector	
Pin name	Function
ISP2	Input connected to the ground to place the microcontroller in recording mode
TX2	Not used
RX2	Receiving data signal
GND	Ground
RX1	Receiving data signal
TX1	Transmisión data signal
ISP	Not used
VCC	Power supply output at 3,3 V
MRNOT	Reset input, active when it is connected to ground
+VI	Power supply output at 12 V (not stabilized, can vary between 8 y 22 V)

JUMPERS CONFIGURATION

Size ¼ of LR72

Connections with the LR72



P5: “Jumper” for configuration of the CAN direction of the expansion.
“Jumper” = ON -+ “1” logic.
Programmable addresses: 1…63 max

P6: “Jumper” to enable or disable the Tele-Alignment process.
Enabled Tele-Alignment = “jumper” placed or ON.

P6

Disabled Tele-Alignment = “jumper” eliminated or OFF.

P6

1 = VPP (channel power)

2 = GND (Channel ground)

3 = VO (Channel voltaje analogue output)

4 = VR (Zero position voltage, when K rely of each channel is inactive.

19.3- EXPANSIONS POWER SUPPLY ELECTRONIC BOARD POT70V4

POT70V4 is an independent and isolated electronic board with 4 power supplies, which are used to supply the output stage of the A2VCAN electronic board's analogue outputs.

This expansion is mounted as datasheet; only the number of required DC/DCs (power supplies) will be mounted. **Each DC/DC can supply the outputs of two A2VCAN; 4 analogue outputs in voltage.**

The energy for POT70V4 module is provided by the LR72 board.

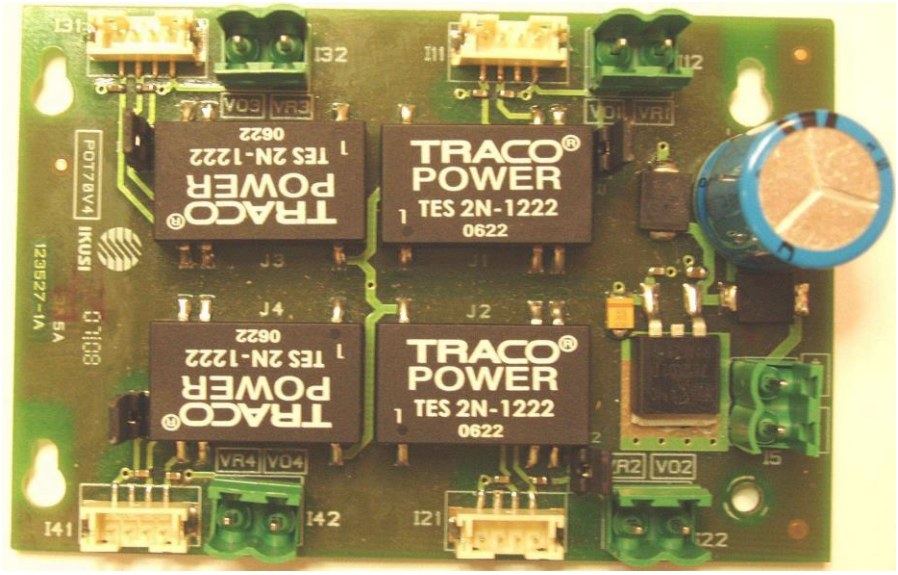
Technical features:

Size ¼ of LR72

2 DC/DC available:

- **12V/0/-12V, 85mA**
- **15V/0/-15V, 65mA**

Power supply range of DC/DC: 9 to 18V



T70/1 & T70/2 ATEX TRANSMITTERS

TM70

IKUSI

20.1- MAIN CHARACTERISTICS

ATEX TRANSMITTER'S TECHNICAL CHARACTERISTICS			
Transmitter type	T70/1 ATEX		T70/2 ATEX
Ingress protection	IP65 / NEMA-4		
Battery life	>8h (50% duty cycle)		
Operating temperature range	-20ºC +70ºC		
Type of battery / Nominal charge	BT06K-ATEX / 500mAh		
Battery charger compatibility	BC70K o CB70		
Orange LED signalling	Replaced by a double signalling: green + red		
DLA option (Display and Limit Range option)	Not available		
Feedback information option	Not available		
Antenna	Internal		
SIMM module –parameter's set up--	Extractable EP70 EEPROM		
Maximum number of maneouvres	6 + START + STOP		10 + START + STOP
Weight –including battery-	500 g		600 g

IKUSI

HEADQUARTER - SPAIN
IKUSI - Ángel Iglesias S.A.
Pº Miramón, 170
20009 San Sebastián, SPAIN
Tel.: +34 943 44 88 00
Fax: +34 943 44 88 20
ikusi@ikusi.com
www.ikusi.com

AUSTRALIA - NEW ZEALAND
IKUSI ANZ PTY LTD
Tel.: +61 3 9720 7022
Fax: +61 3 9720 7422
ika@ikusi.com

CHILE
INGENIERÍA IKUSI CHILE, LTDA.
Tel.: +56 2 335 9661
Fax: +56 2 233 7511
ikc@ikusi.com

FRANCE
IKUSI FRANCE SARL
Tel.: +33 1 43 03 52 22
Fax: +33 1 43 03 52 42
ikf@ikusi.com

MEXICO
IKUSI MÉXICO, S.A. DE C.V.
Tel.: +52 55 5663 8600
Fax: +52 55 5663 8684
contacto@ikusi-gs.com.mx

GERMANY
IKUSI GmbH
Tel.: +49 8464602420
Fax: +49 8464602423
ikd@ikusi.com

PORTUGAL
IKUSI ELECTRÓNICA, LDA.
Tel.: +351 22 947 8240
Fax: +351 22 947 8249
ikp@ikusi.com

RUSSIA
IKUSI, LLC.
Tel.: +7 495 583 93 41
Fax: +7 495 586 17 71
ikr@ikusi.com

UNITED ARAB EMIRATES
IKUSI MIDDLE EAST FZE
Tel.: +971 4 204 5606
Fax: +971 4 204 5610
ikme@ikusi.com

COLOMBIA
IKUSI COLOMBIA, S.A.
Tel.: +57 1 638 63 54
Fax: +57 1 621 15 65
airports@ikusi.com