


# T221 LIN/ALIN Bridge USER GUIDE

## OVERVIEW

Figure  A shows schematically T221 bridges linking segments of ALIN to a single LIN in a typical configuration.

## Main features of the T221

- Links LIN to ALIN
- No configuration required
- Automatically installs diagnostics blocks
- Automatic support of LIN cable redundancy, bridge redundancy and route redundancy
- Up to 64 dedicated database or file transfer instrument-to-instrument connections per bridge
- Compatible with existing instruments and configurators
- Supports up to fifteen T640s on the ALIN
- Full communications between ALIN segments
- Up to 254 instruments on an entire network

## UNPACKING YOUR T221

Unpack the instrument and accessories carefully and inspect the contents for damage. Keep the original packing materials in case re-shipment is required. If there is evidence of shipping damage, please notify Eurotherm Process Automation or the carrier within 72 hours and retain the packaging for inspection by the manufacturer's and/or carrier's representative.

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### Caution

**Handling precautions.** Some of the circuit boards inside the T221 contain electrostatically sensitive components. To avoid damage, before you remove or handle any board ensure that you, the working area, and the board are electrostatically grounded. Handle boards only by their edges and do not touch the connectors.

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## Package contents

Check the package contents against your order codes, using the labels on the components to help you. Product labelling includes:

- Outer packaging label. Shows the full instrument order code, instrument serial number, hardware build level, and software issue number.
- Antistatic bag label. Shows the full instrument order code, instrument serial number, and hardware build level.
- Sleeve labels. Two labels, one outside and one inside showing the sleeve order code and sales order number.
- Instrument label. One on the instrument, identical to the antistatic bag label.
- Memory module label. One label showing the software issue number.

## INSTALLATION

### Dimensions

Figure □ C shows the DIN-size aperture ① needed for panel-mounting the T221. Also shown are the unit's overall dimensions, the mounting clamps ②, panel section ③, terminal cover ④ and screw ⑤, and the access for cabling ⑥.

### Panel mounting

Insert the sleeve in the aperture and fit the two clamps as shown in Figure □ B. To fit a clamp, position it flat on the sleeve, locating the hook ① in the slot. Slide the clamp away from the panel to engage the hook firmly, and snap the two feet ② into the two small recesses. Screw the clamp rod in to hold the sleeve lightly in position. Fit the second clamp in the same way. Finally, tighten up both clamps to exert a moderate retaining force. To avoid panel distortion, do not overtighten. The maximum recommended torque is 0.6Nm.

### Clamp removal

See Figure □ D. Slacken off the clamp by at least 2mm and insert a screwdriver blade between the feet at the end of the clamp body. Lift the screwdriver handle to lever the clamp towards the panel and disengage it. Do not press downwards — this could cause damage.

### Removing T221 from sleeve

Withdrawing the T221 from its sleeve is done entirely from the front of the mounting panel, without disturbing any of the system wiring.

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#### Caution

Repeated removal/replacement of the T221 under power erodes the connectors. Anti-static precautions must be observed when handling the unit out of its sleeve.

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See Figure **□ E**. To unlock the T221 insert a small screwdriver blade into the slot ① in the retaining clip at the bottom of the fascia and slide the clip to the left as far as it will go. Repeat this for the clip at the top of the fascia, but slide it to the right. To withdraw the unit use the extractor tool supplied in the accessory kit (Part No. BD 082253). Hold the tool ② at an angle of about 45°, insert the hook into the opening ③, then level the tool and pull the unit from the sleeve. Remember to lock both retaining clips after refitting the unit in the sleeve.

## CONNECTIONS & WIRING

Electrical connections to the T221 are made via terminals at the rear of the sleeve, protected by a terminal cover. Wiring passes through the opening in the base of the terminal cover. All screw terminal connections are low current and a 16/0.20 cable size is adequate. The maximum cable size for these terminals is 2.5mm<sup>2</sup>. 'Bootlace' type ferrules are strongly recommended.

**Power input.** The instrument supply should be fused externally in accordance with local wiring regulations. The mains option accepts 90 - 265 Vac, 50 - 60 Hz, the DC option 19 - 55 Vdc. Power input is a nominal maximum of 25VA per T221.

### Terminal cover removal

See Figure **□ F**. With the sleeve upright unscrew the retaining screw ① and pull the cover ② away from the cover bracket ③ and cable clamp ④ assembly. To remove the bracket, lift it to free the hooks ⑤ from the tabs ⑥, then withdraw it from the sleeve. Refitting the bracket and cover is the reverse procedure.

### Customer terminals

Figure **□ G** shows the rear-panel connectors and customer terminals (example). Other configurations are possible depending on the power supply ordered. The Figure shows the MAINS option motherboard terminal block ① with safety cover ②, forwarding status relay terminals ③, RS232 diagnostic port ④, LIN connectors ⑤, and LIN status LEDs ⑥. Wire connectors ⑦, securing screws ⑧, and terminal identification labels ⑨ are also shown. Connect a good local earth (DC option), or the mains earth (MAINS option), to the M4 screw terminal ⑩. *Do not* connect an external earth directly to terminals 1 and 2.

The LIN attaches to the two coaxial BNC-type sockets ⑤, via right-angled connectors. Fit 'T'-pieces to the ends of the short cable stubs outside the terminal cover. The upper 'LIN A' socket must be used for a T221 without a redundant LIN; leave the lower socket 'LIN B' unconnected in this case. Use only approved cable and connectors, as described in the *LIN User Guide* (Part Number HA 082 429 U005). The ALIN connects directly to screw terminals 20, 21, and 22. See the *LIN User Guide* for installation details. The 'DIAG' port ④ lets you attach a serial terminal or terminal emulator using RS232 communications. Comms parameters are 9600 baud, 7 bits, 1 stop bit, even parity. Use a side-entry 'D-type' 9-way connector. Figure **□ J** shows the diagnostic port pinouts.

**Mains safety cover ②**

This fits over the mains screw terminals to prevent accidental contact with the live screws. To remove the cover loosen the two screws ① and pull it off. To replace the cover insert its two legs fully into the corresponding terminals and tighten up the screws securely.

**Terminal designations**

Table 1 shows the terminal designations for the MAINS and the DC motherboard terminal block options.

Forwarding status relay terminals 1A and 1B (not shown in the Table) are closed when network traffic is normal. Please refer to the *Diagnostic displays* section below for more details.

Motherboard (Mains option)	Motherboard (DC option)
- } Mains earth screw - } terminal (M4)	- } Earth screw terminal (M4)
1 Internal earth †	1 Internal earth †
2 Internal earth †	2 Internal earth †
-	-
L Mains live	-
N Mains neutral	-
-	-
-	7 DC source 1 +ve
-	8 DC source 1 -ve
-	9 DC source 2 +ve
-	10 DC source 2 -ve
11 -	11 -
12 -	12 -
13 -	13 -
14 -	14 -
15 -	15 -
16 W/dog & LIN alarm { fails	16 W/dog & LIN alarm { fails
17 W/dog & LIN alarm { open	17 W/dog & LIN alarm { open
18 ALIN alarm { fails	18 ALIN alarm { fails
19 ALIN alarm { open	19 ALIN alarm { open
20 ALIN ground	20 ALIN ground
21 ALIN phase A	21 ALIN phase A
22 ALIN phase B	22 ALIN phase B

†Do not connect externally

Table 1 Motherboard connections

**T221 power & zero volts schematics**

Figures □ H and □ I show T221's internal zero volts and power supply arrangements and associated customer screw terminals, for the MAINS and DC options respectively. The power supply units ① feed the main CPU ②, bridge board ③, and front panel ④, via power supply bus ⑤. The GND terminal connects directly to the instrument case ⑥, and via wires to terminals 1 and 2. In the DC option, failure of either input is signalled via opto-isolators ⑦ to the CPU ②, which sets the relevant bit in the database (T221 block).

**Diagnostic port schematic**

Figure □ J shows the diagnostic port zero volts arrangements and pinouts. Signals via the DIAG connector ① are limited to ±28V ②, and level-shifted ③ on their way to and from the communications controller ④. ⑤ is the main CPU.

**LIN communications schematic**

Figure □ K shows the LIN comms connections with associated customer terminals. Signals received via the LIN A or LIN B sockets ① pass to their respective LIN transceiver (② or ③) and are subjected to fault-detection procedures in the redundant LIN monitor ④, which reports to the CPU ⑤. Using the LIN redundancy algorithm, the CPU sets switch ⑥ to select which signal is to be listened to — RXA or RXB. This signal passes on to the comms controller ⑦.

The comms controller transmits a common signal TX on both LIN channels. The CPU ⑤ controls the driver ⑥ which operates the rear-panel diagnostic bi-colour LEDs ⑨.

## ALIN communications schematic

Figure □ L shows the ALIN comms connections and associated customer screw terminals. ① is the ALIN interface circuitry, and ② is the CPU.

NOTE. The ALIN cable screen should be grounded at one point only.

## BLOCK SCHEMATICS

### Motherboard & front panel

Figure □ M shows the motherboard ① and front panel ② block schematics. The main CPU ③, RAM ④, and EEPROM memory module ⑤ are interconnected on a bus which links to the bridge board via a 32-way connector ⑥. The CPU controls the relay ⑦ and comms interface ⑧, receiving power from ⑨. T221's rear-panel connections are the ALIN alarm ⑩, watchdog/LIN alarm ⑪, power input option ⑫, and ALIN ⑬. DIL switchbanks 1 & 2 ⑭ report their status to the CPU. The front-panel's LEDs ⑮ receive power and CPU control from the motherboard via one 12-way connector.

### Bridge board & bridge connector board

Figure □ N shows schematically the bridge ① and bridge connector ② boards. The dual-port RAM ③ and comms controller ④ are bussed together and to the motherboard via the 32-way connector ⑤. Signals from this bus operate the forwarding relay ⑥ and the LIN status LEDs driver ⑦. DIAG port ⑧ communicates with the comms controller ④. LIN A and B transceivers ⑨ are monitored by the redundant line monitor ⑩. See the section *LIN communications schematic* above, and Figure □ K, for more details. DIL switchbanks 3 & 4 ⑪ also connect to the bus.

## HARDWARE CONFIGURATION

### Internal layout

Figure □ O shows T221's internal layout. The motherboard ① is the main electronics board, carrying two configuration DIL switchbanks 1 and 2 (② and ③), and the memory module ④ in its socket ⑤. The bridge board ⑥ carries the LIN circuitry, and DIL switchbanks 3 and 4 (⑦ and ⑧). It plugs into the bridge connector board ⑨ — mounted in the sleeve — via socket ⑩. This board carries the two rear-panel LIN sockets ⑪, the RS232 diagnostic connector ⑫, and the two LIN diagnostic LEDs (not shown).

The bridge board ⑥ also plugs into the rear-panel '1A' and '1B' LIN-forwarding screw terminals (not shown) via edge-connector ⑬.

## Memory module removal

See Figure □ O. Use a screwdriver blade to slide the retaining clip ⑭ towards the front panel ⑮ as far as it will go, then pull the module out of its socket. Replacement is the reverse procedure.

### Caution

The module can be pushed fully home only if it is the right way round. Check this before applying excessive force, which can damage the pins.

## Main fuse

See Figure □ P. The motherboard carries the T221 main fuseholder ①. The fuse is a 20 × 5 mm 250Vac antisurge cartridge fuse rated at 500mA (AC option), or 2A (DC option). Unscrew the fuse cap anticlockwise to remove.

## Switchbanks 1 & 2

Table 2 summarises the uses of T221's four DIL switchbanks. More details are given in the *Safety features & diagnostic displays* section following.

Switch	Motherboard		Bridge board	
	SW1	SW2	SW3 <sup>[3]</sup>	SW4 <sup>[3]</sup>
1	POST enable <sup>[1]</sup>	LSB } } Network } Address } } } } } } } MSB	LSB } } LIN segment } (future) } } } } } } } MSB	LSB } } ALIN segment } (future) } } } } } } } MSB
2	Auto config enable <sup>[1]</sup>			
3	Debug LEDs enable <sup>[2]</sup>			
4	Watchdog disable <sup>[2]</sup>			
5	(Unused) <sup>[2]</sup>			
6	(Unused) <sup>[2]</sup>			
7	(Unused) <sup>[2]</sup>			
8	(Unused) <sup>[2]</sup>			

[1] 'On' for normal operation. [2] 'Off' for normal operation.

[3] All these switches must be 'off' at this issue

Table 2 Switchbanks SW1 to SW4 settings

## SAFETY FEATURES & DIAGNOSTIC DISPLAYS

### Power-on self-test (POST)

On power-up, if 'POST enable' switch SW1-1 is ON, the instrument performs a comprehensive self-test. Table 3 shows the messages that appear on the terminal screen connected via the DIAG port.

T221 POST Diagnostics

(c) EPA(TCS) 1993

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2x32kB RAM chips fitted
Main board SW1: 03 SW2 (MAC addr): 3C LIN board SW3: 00 SW4: 00
CPU speed Count 0C36 = 12.5MHz Pass
PROM checksums 64A6
RAM test 1 Seg: 4000 Pass
RAM test 2 Seg: 4000 Pass
RAM test 3 Seg: 4000 Pass
RAM test 4 Seg: 4000 Pass
LIN anti-jabber Pass 26 milliseconds
LIN 7960 preamble time Pass 30 microseconds
ISCC Interrupt Pass
LIN A receive status Pass
LIN B receive status Pass
LIN A test Pass
LIN B test Pass
ISCC DMA Test Pass
ISCC DMA Memory Test 1 Pass
ISCC DMA Memory Test 2 Pass

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Table 3 Power-on self-test messages

NOTE. Some of the LIN and ISCC tests will fail if the instrument is connected to an active LIN. It will not, however, disrupt other instruments on the LIN.


## Automatic configuration of diagnostic blocks

With SW1-2 ON ('Auto config enable'), the T221 automatically configures a set of diagnostic function blocks, named in Table 4. In the Table, the suffix *nn* represents the network node number of the instrument. Please refer to the *LIN Blocks Reference Manual* for details of the diagnostic block functions.

T221 <sub>nn</sub>	LDIAG <sub>nn</sub>	ETBL <sub>nn</sub>	ROUTE <sub>nn</sub>	CTBL <sub>nn</sub>	PTBL <sub>nn</sub>	NMAP <sub>nn</sub>
T221T <sub>nn</sub>	ALIND <sub>nn</sub>	EDIAG <sub>nn</sub>	RDIAG <sub>nn</sub>	CDIAG <sub>nn</sub>	PDIAG <sub>nn</sub>	FDIAG <sub>nn</sub>
LRA <sub>nn</sub>	LDEXT <sub>nn</sub>	DDIAG <sub>nn</sub>	FLOG <sub>nn</sub>	CENT <sub>nn</sub>	PENT <sub>nn</sub>	BDIAG <sub>nn</sub>
NDIAG <sub>nn</sub>	XDIAG <sub>nn</sub>					

Table 4 Diagnostic blocks created if SW1-2 is ON

## Front-panel LEDs

Figure  Q shows the front panel, which has five LEDs. As a self-test, all LEDs light for about one second as soon as the bridge starts to function.

With SW1-3 OFF ('Debug LEDs enable'), the LEDs display the information indicated by their front-panel symbols, i.e.:

- The green power LED ①, symbol **O/I**, is lit whenever power is applied.
- The LIN fail LED ②, symbol **!**, flashes red (and the Watchdog/LIN alarm relay contacts open — rear-panel terminals 16, 17) when LIN comms have failed. If communication is possible, i.e. a token is being passed, the LED remains off (and the relay holds closed).
- The LIN forward LED ③, symbol **ALIN ► LIN**, flashes yellow momentarily when a message is passing from the ALIN onto the LIN.
- The ALIN fail LED ④, symbol **!**, flashes red (and the ALIN alarm relay contacts open — rear-panel terminals 18, 19) when ALIN comms have failed. If communication is possible the LED remains off (and the relay holds closed).
- The ALIN forward LED ⑤, symbol **LIN ► ALIN**, flashes yellow momentarily when a message is passing from the LIN onto the ALIN.

With SW1-3 ON, the front-panel LEDs perform a T221 task-monitoring function (*Eurotherm Process Automation use only*).

## Rear-panel LIN status LEDs

Figure □ G shows T221's rear panel. Two bi-coloured (green/red) LEDs ⑥, labelled 'LIN A' and 'LIN B', show the status of the respective LIN channels. These LEDs are tested during the power-on self-test procedure (POST).

Table 5 indicates the use of the rear-panel status LEDs.

LIN A LED	LIN B LED	LIN Status
Off	Off	Not used (no power)
Green steady	Green flashing	Channel A working, Channel B standby
Green flashing	Green steady	Channel B working, Channel A standby
Green flashing	Green flashing	Token not being passed (no other instruments attached)
Green steady	Red flashing	Channel A working, Channel B LRA fault
Red flashing	Green steady	Channel B working, Channel A LRA fault
Red flashing	Red flashing	LRA fault on both channels
Green flashing	Red flashing	Channel A standby, using faulty channel B (forced mode)
Red flashing	Green flashing	Channel B standby, using faulty channel A (forced mode)
Red steady	Red steady	Hardware or addressing fault

Table 5 Rear-panel LIN status LEDs



## ALIN alarm relay

Customer terminals 18 & 19 (see Table 1). The relay contacts are closed when energised and in the no-alarm condition, but open when an ALIN failure occurs in the T221. They also open if the relay is de-energised, i.e. fail safe.

## Watchdog & LIN alarm relay

Customer terminals 16 & 17 (see Table 1). This relay monitors the health of the main processor and LIN comms. The contacts are closed when energised and in the healthy condition, but open if either the CPU or the LIN comms fails. Additionally, the front panel LIN fail LED (†) flashes red until normal LIN operation has been restored.

The CPU can also force the watchdog to trip when a T221 task 'hangs up'. This facility may be disabled by setting motherboard DIL switch SW1-4 ('Watchdog disable') to ON.

**NOTE.** If the CPU fails, the processor automatically resets and attempts to restart. If restart is successful the watchdog relay closes again.

## Forwarding status relay

The Forwarding status relay contacts (rear-panel terminals 1A, 1B — ③ in Figure □ G) close whenever message-forwarding in either direction has occurred in the last 30 seconds; otherwise they remain open. In practice this means that for normal network traffic this relay is closed continuously.

# NETWORK OPERATION

## Basic topology

Figure □ A shows schematically an example of how T221s may be used to link multiple segments of ALIN to a single LIN network. In the configuration illustrated, full peer-to-peer communications are maintained between all instruments.

## Transparency

The T221 is not referenced when caching blocks or transferring files, and the target instrument is addressed directly as if a T221 bridge were not there. Apart from the initial configuration of the T221 (via SW1), and the setting up of the network address switches (SW2), the unit requires no further configuration.

## Addressing

All instruments, including T221s, interconnected on LIN and ALIN must have unique addresses in the range 01 to FE. Addresses 00 and FF are forbidden.

A T221 address must have the same leading hex digit as the addresses of T640s on the associated ALIN. E.g. a T221 on address E2 can service only T640s with ALIN addresses in the range E0 to EF.

## Module redundancy

An ALIN segment may be linked to the LIN by more than one T221 bridge. These T221s then work in a fault-tolerant (redundant) mode, and share the load. It follows from the address rules given in the previous section that the redundant T221s must all reside in the same address range (i.e. common leading hex digit) as that of the associated T640s, and therefore reside in the same address range as each other.

Figure **□ R** shows an example redundant layout with three T221 bridges linking the LIN to five T640s on an ALIN segment. In the Figure, the network addresses are indicated on each instrument fascia.

## Load-sharing

Redundant T221 bridges automatically share the load according to the following rules. ALIN T640 addresses are divided into numerically consecutive 'service groups', one group for each operating T221. A service group normally has a range of addresses starting at the address of its associated T221 and ending just before the address of the next-higher addressed T221. However, any T640s at lower addresses than the lowest-addressed T221 are included in its service group.

Applying these rules to Figure **□ R**, with all bridges operational:

- T221 at address 93 services T640s at addresses 90 and 94
- T221 '97' services T640 '99'
- T221 '9A' services T640s '9B' and '9C'

In the event that bridge '97' fails and goes offline, the service groups redefine themselves, and now:

- T221 '93' services T640s '90', '94', and '99'
- T221 '9A' services T640s '9B' and '9C'

Transient communications (software) alarms are generated as T221s go on- and off-line.

## ORDERING OPTIONS

The T221 can be ordered as a complete package including DIN sleeve. The order codes required for this are given in Table 6. Sleeves (T720) are also separately orderable using the order codes listed in Table 7.

### T221 Order codes

CODE	DESCRIPTION
<b>T221</b>	<b>Base unit</b> Bridge
<b>MAINS DC</b>	<b>Power supply</b> Universal mains 90 to 265 volts ac rms 19 to 55 volts dc power supply
<b>422</b> <b>485</b> —	<b>Additional serial communications</b> <i>(Not yet available)</i> <i>(Not yet available)</i> None fitted
<b>LIN RLIN</b>	<b>LIN</b> Redundant LIN not supported Redundant LIN supported
— <b>MODEM</b>	<b>Modem</b> No modem output fitted <i>(Not yet available)</i>
<b>T720</b> —	<b>Sleeve</b> Supplied in a sleeve (to suit power supply option) No sleeve supplied
<b>EN</b> <b>FR</b> <b>GE</b> <b>IT</b> <b>IT</b> <b>SP</b> <b>PO</b> <b>CY</b>	<b>Labelling language</b> English French German Italian <i>(Not yet available)</i> <i>(Not yet available)</i> <i>(Not yet available)</i> <i>(Not yet available)</i>

Example: T221/MAINS/ — /RLIN/ — /T720/EN

Table 6 T221 order codes

## T720 Sleeve (ordered separately)

ENGLISH

CODE	DESCRIPTION
<b>T720</b>	<b>Base unit</b> Bridge DIN sleeve
<b>MAINS</b>	<b>Power supply connector assembly</b> Universal mains 90 to 265 volts ac rms
<b>DC</b>	19 to 55 volts dc power supply
	<b>Labelling language</b>
<b>EN</b>	English
<b>FR</b>	French
<b>GE</b>	German
<b>IT</b>	Italian
<b>SW</b>	<i>(Not yet available)</i>
<b>SP</b>	<i>(Not yet available)</i>
<b>PO</b>	<i>(Not yet available)</i>
<b>CY</b>	<i>(Not yet available)</i>


Example: T720/DC/FR

Table 7 T720 sleeve order codes

## SPECIFICATIONS

### T221 base unit

#### Panel cut-out

Please refer to Figure  C which shows the DIN-sized panel cut-out.

#### Mechanical

Fascia dimensions:	height 144mm, width 72mm.
Mounting panel aperture:	height 138 +1 –0 mm, width 68 +0.7 –0 mm.
Behind mounting panel:	depth 258mm (measured from panel front).
Front of mounting panel:	depth 10.6mm.
Weight:	1.45kg.

#### Environmental

Storage Temperature:	–10°C to +85°C.
Operating Temperature:	0°C to +50°C.
Front panel sealing:	designed to meet IP65.
RFI susceptibility:	designed to meet IEC801 Parts 2-4, Acceptability Class 2.
Instrument safety:	to meet BS4743 class I.
Isolation:	to meet BS4743, with isolated I/O as Class II.
Vibration:	to meet BS2011 Part 2.1, Test Fc, Table CII, 'Equipment intended for large power plant and general industrial use' (2g, 10-55 Hz).
Shock:	to meet BS2011 Part2.1, Test Ea, Table II, 'General test for robustness, handling and transport' (15g, 11ms).

#### Front panel LEDs

All front-panel LEDs self-test at power-up.

Power-on indicator:	green LED, symbol:	<b>O/I</b>
LIN fail indicator:	red flashing LED, symbol:	<b>!</b>
LIN forward indicator:	yellow LED, symbol:	<b>ALIN ► LIN</b>
ALIN fail indicator:	red flashing LED, symbol:	<b>!</b>
ALIN forward indicator:	yellow LED, symbol:	<b>LIN ► ALIN</b>

#### Rear panel LEDs

Rear-panel LEDs self-test during power-on self-test procedure (POST).

LIN A status:	bi-colour green/red LED; flashing/steady.
LIN B status:	bi-colour green/red LED; flashing/steady.

### Rear-panel connections

Earth terminal (GND):	M4 screw.
Motherboard:	22-way screw-terminal connector block. 2.5mm <sup>2</sup> maximum cable size.
Forwarding status relay:	2-way screw-terminal connector block. 2.5mm <sup>2</sup> maximum cable size.
Diagnostic port (DIAG):	9-way 'D-type' male plug.
LIN A, LIN B:	2-off coaxial (BNC) sockets.

### Relays

ALIN alarm relay:	SPST. 24V ac/dc at 1A. Absolute maximum rating 60V.
Watchdog & LIN alarm relay:	SPST. 24V ac/dc at 1A. Absolute maximum rating 60V.
Forwarding relay:	SPST. 24V ac/dc at 1A. Absolute maximum rating 60V.

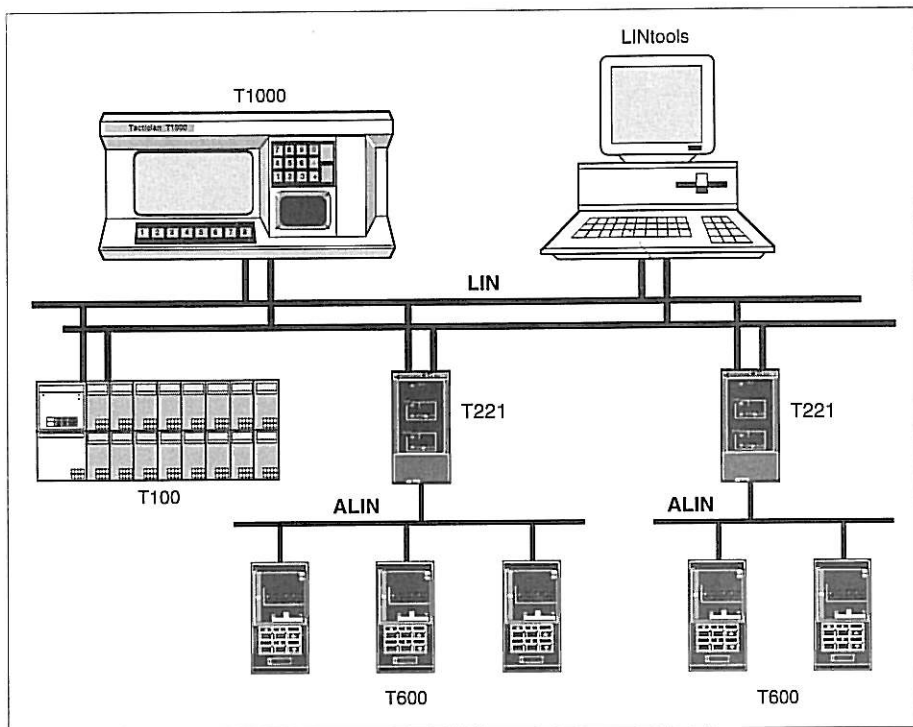
### Power supplies

#### Mains version

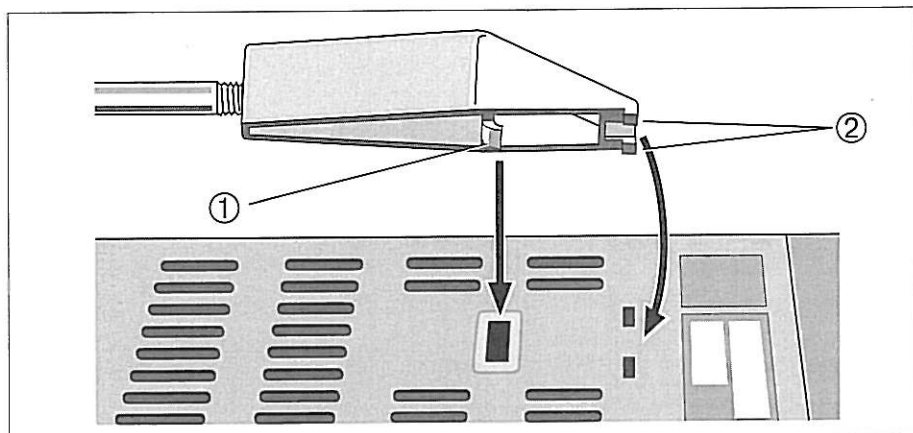
Input voltage range:	90 - 265 Vac rms.
Input frequency range:	45 - 65 Hz.
Maximum peak input current:	1.1A.
Power rating:	25VA.
Holdup time:	20ms.
Fuse:	20 × 5 mm 250Vac antisurge cartridge, 500mA.

#### DC version

Number of inputs:	2 — Channel 1 (main input), channel 2 (backup).
Input voltage range:	19 - 55 V (including rectified 48Vac).
Power rating:	25VA.
Holdup time:	20ms.
Fuse:	20 × 5 mm 250Vac antisurge cartridge, 2A.



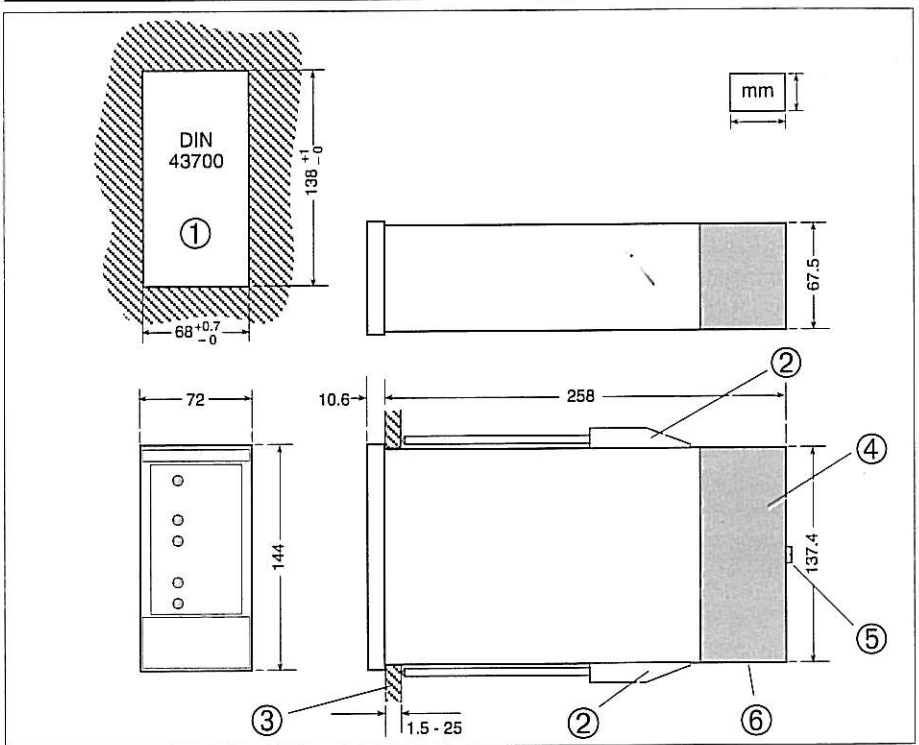
□ A



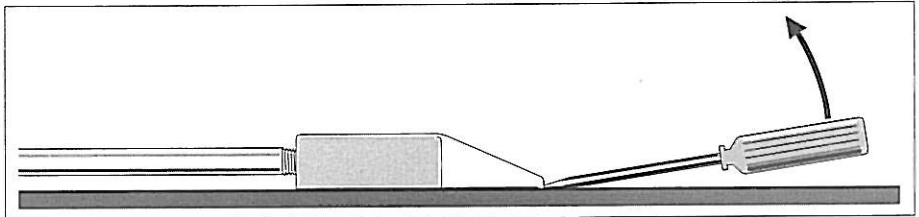
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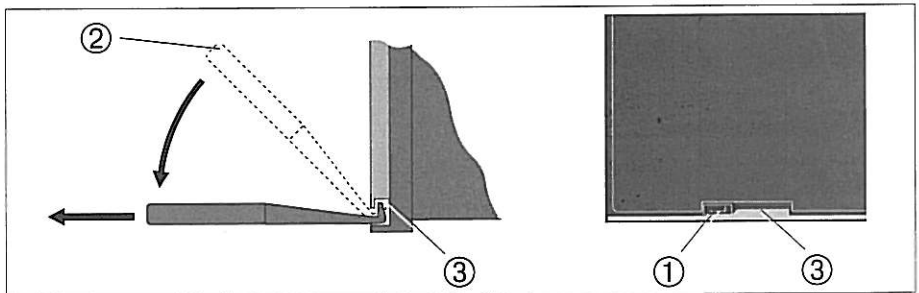




□ C

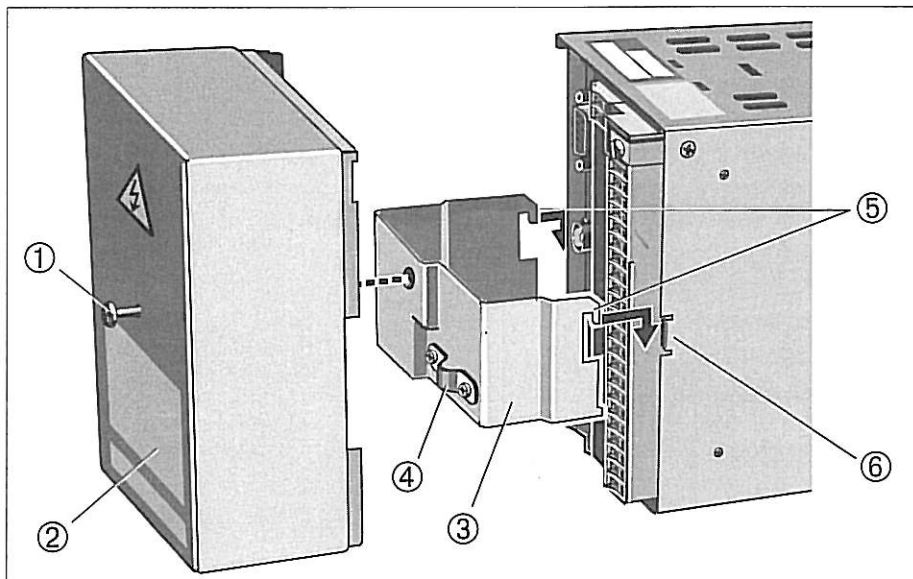


□ D

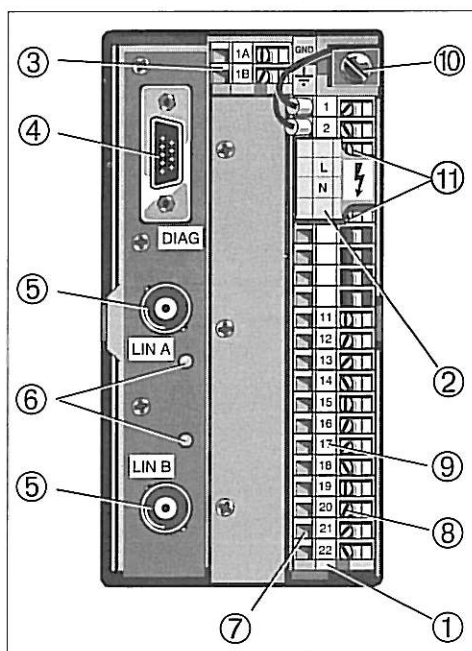


□ E



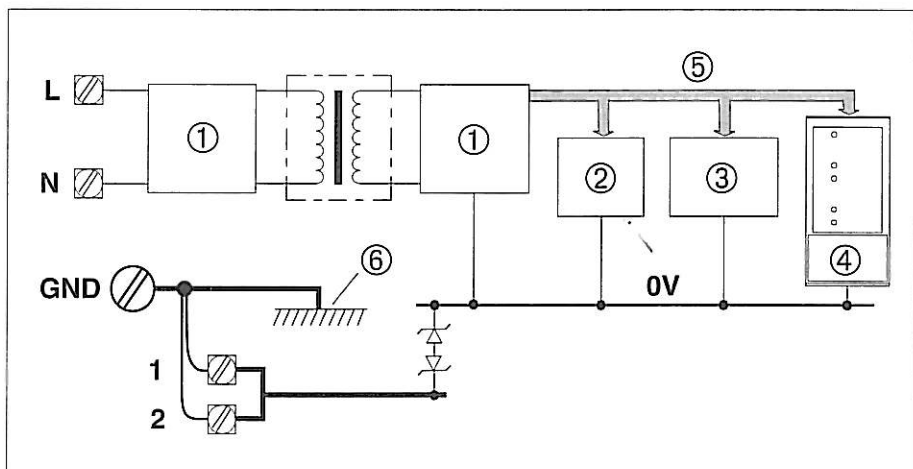


□ F

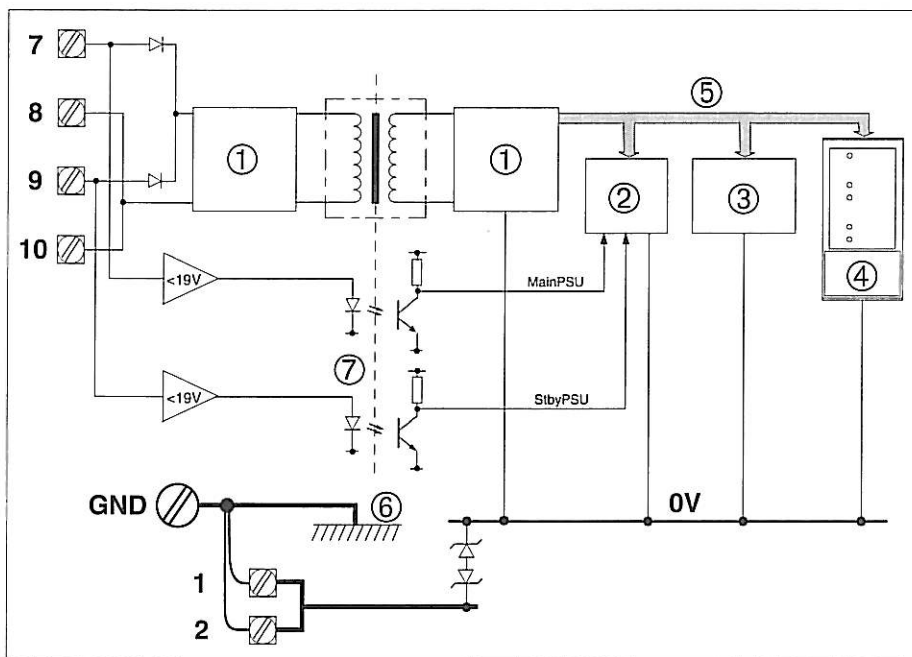


□ G



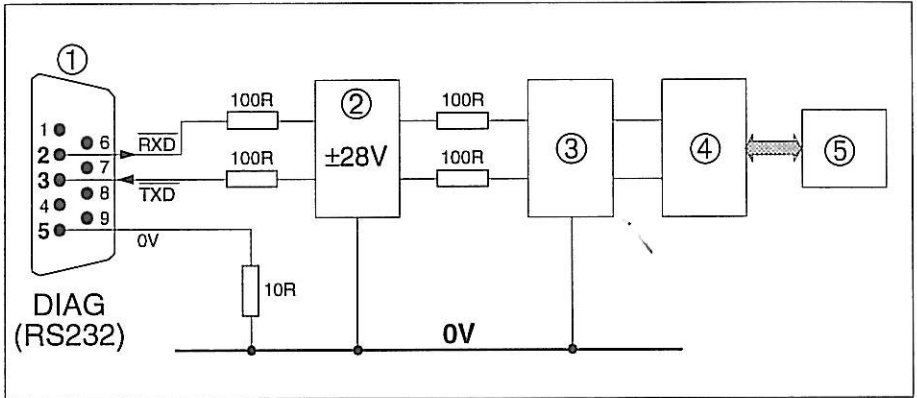


□ H

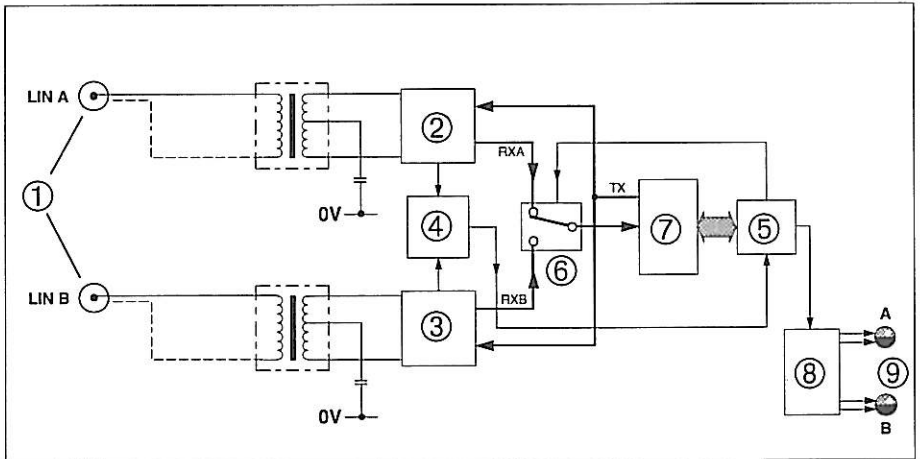


□ I

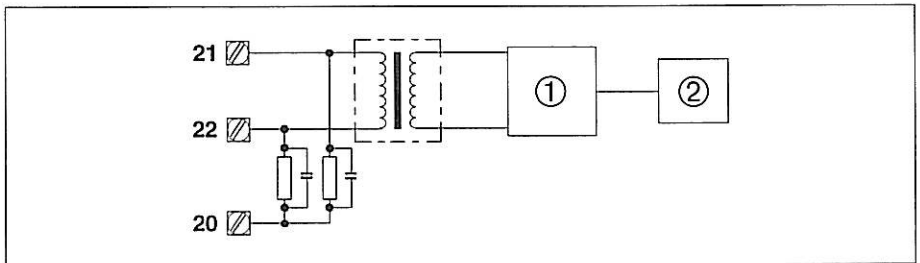




□ J



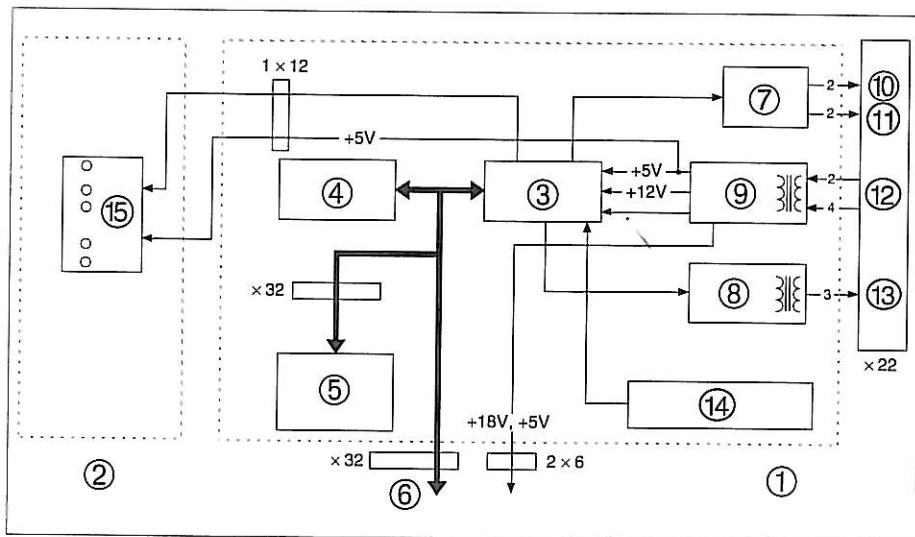
□ K



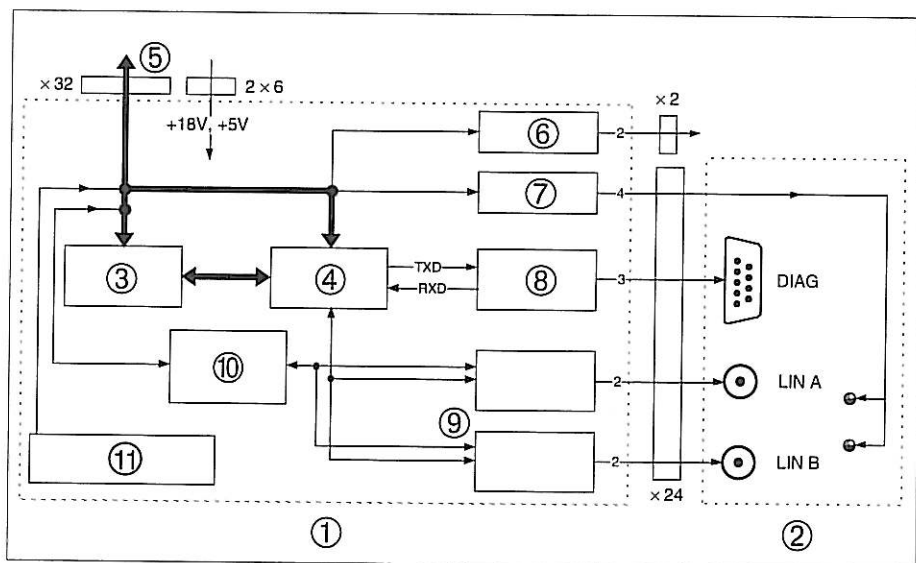
□ L





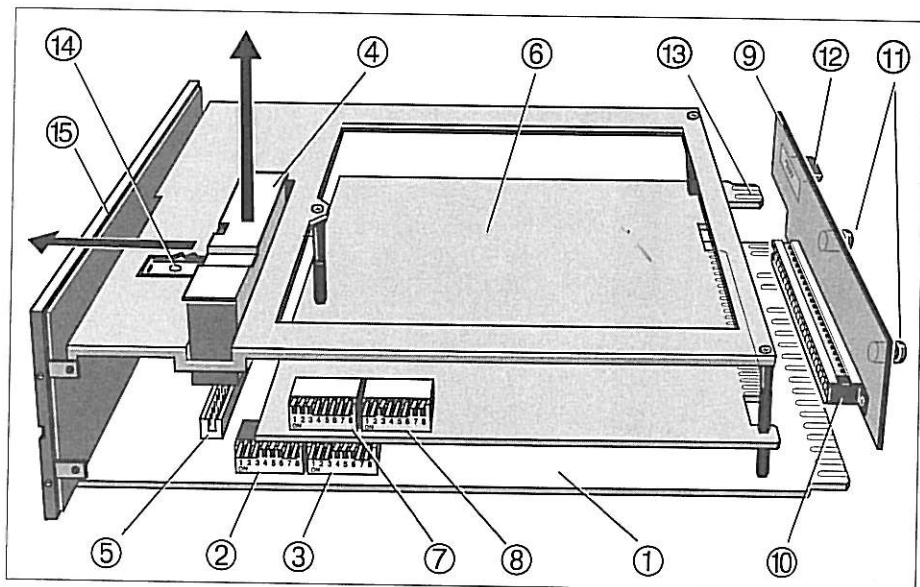


□ M

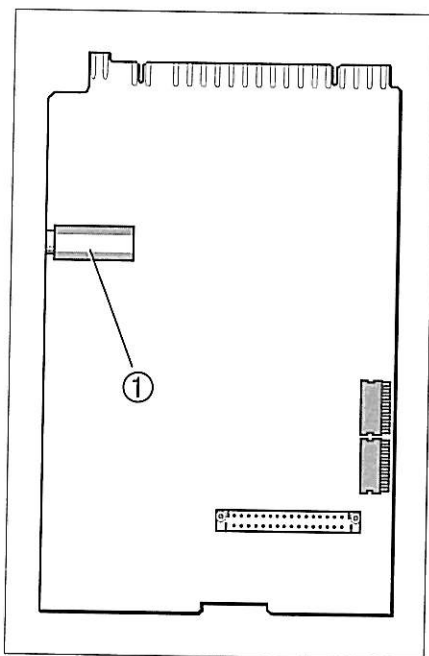


□ N



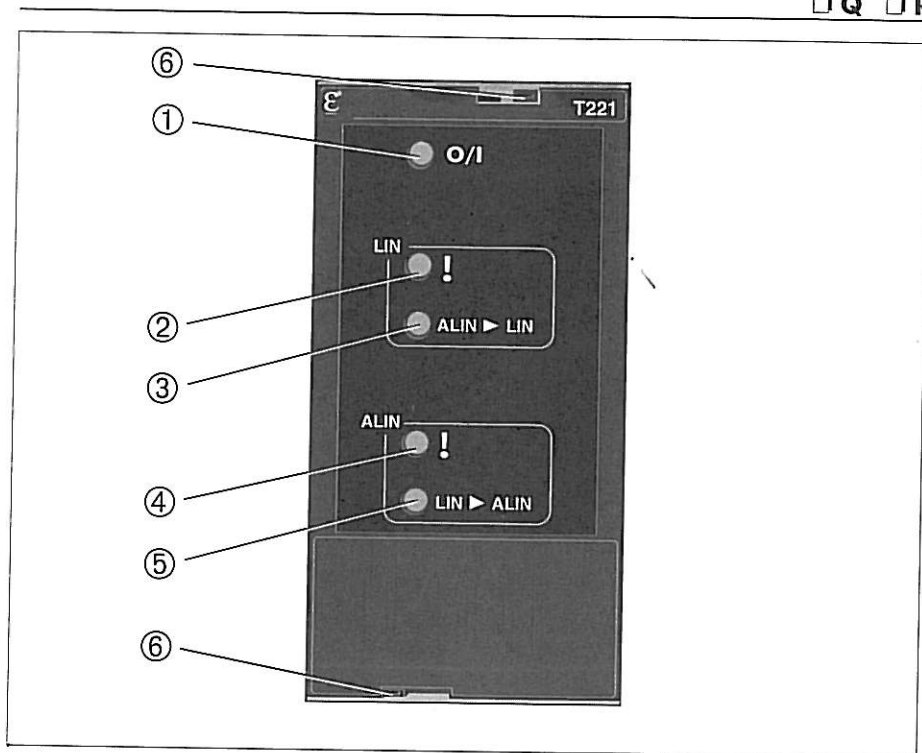


□ ○

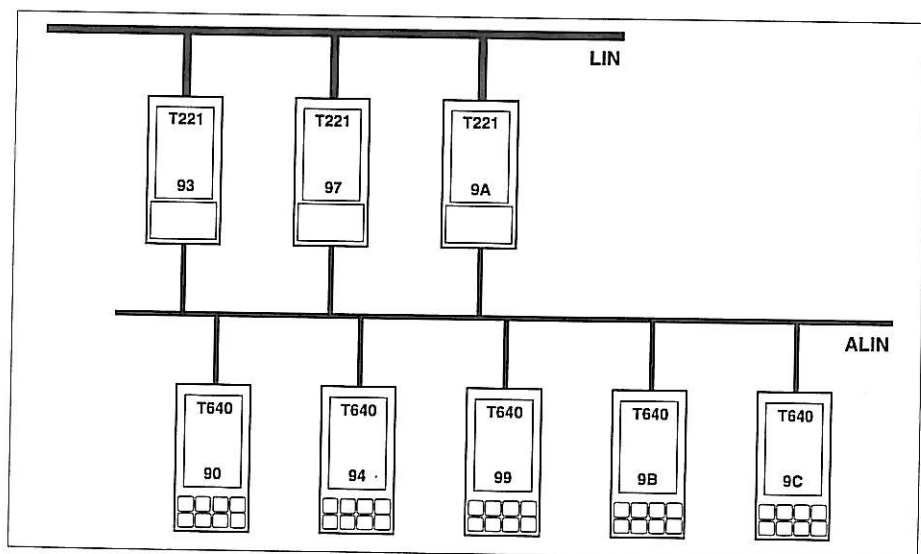


□ P





□ Q



□ R



# T221 V1/2 User Guide Addendum



The following notes should be used in conjunction with the T221 LIN/ALIN Bridge User Guide Issue 1/B.

## SWITCH SETTINGS

The following table supersedes Table 2 on page 6.

Access to the switches is gained by removing the instrument from its case.

	Motherboard		Bridge board		
	SW1-x	on/off	SW2-x	SW3-x	SW4-x
SWx-1	POST enable / disable		LSB  Network Address  MSB	LSB  LIN segment (future)  MSB	LSB  ALIN segment (future)  MSB
SWx-2	Auto config enable / disable				
SWx-3	Debug LEDs enable / disable				
SWx-4	Watchdog disable / enable				
SWx-5	LIN kill enable / disable				
SWx-6	Manual reset enable / disable				
SWx-7	Unused				
SWx-8	Unused				

In normal operation, the following switches should be set:

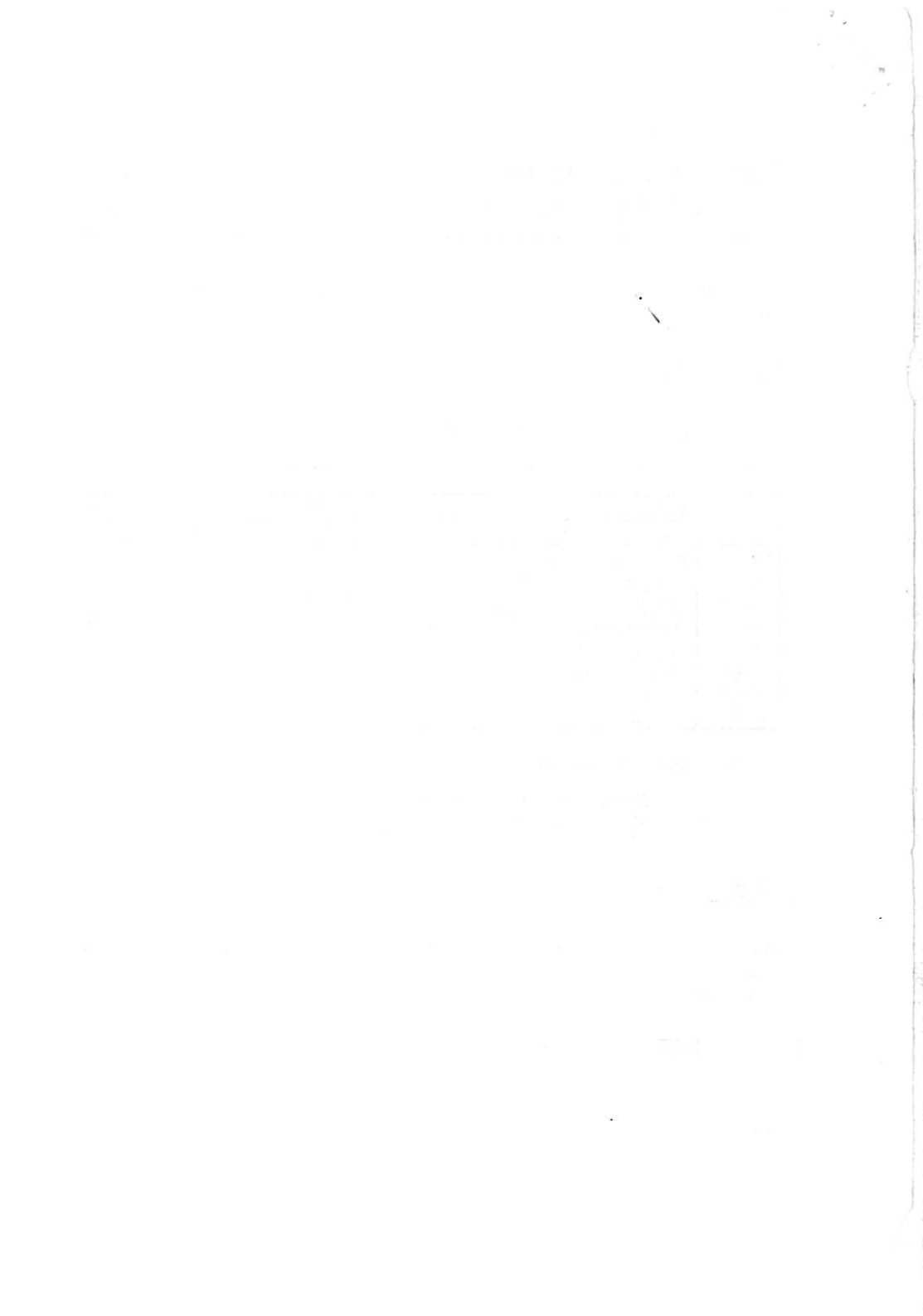
- SW1-1 & SW1-2 should be on, SW1-3 to SW1-8 should be off.
- SW2-1 to SW2-8 should set the network address.
- SW3-1 to SW3-8 and SW4-1 to SW4-8 must be off.

## DIAGNOSTIC PORT

The DIAG port allows the user to attach a serial terminal or terminal emulator to the instrument, using RS232 communication. The communication parameters are 9600 baud, 7bits, 1 stop bit, even parity.

## NETWORK OPERATION

The "Addressing", "Module redundancy" and "Load-sharing" sections on pages 9 and 10 are superseded by the following:





## Addressing

Most LIN instruments and all ALIN instruments now use an extended LIN protocol (XLIN) which includes 16 bit network addresses. Instruments using the original LIN protocol (LIN) continue to work with 8 bit node addresses. A 16 bit network address comprises an 8 bit node address and an 8 bit segment address.

The protocols supported by various instruments are as follows:

Instrument	Revision	Protocol
T100/T1000	Up to 3/x	LIN
T100/T1000	From 5/1	XLIN
T231	Up to 4/2	LIN
PCLIN	Up to 4/x	LIN
PCLIN	From 5/1	XLIN
QLIN	All	LIN
T221	From 1/1	XLIN
All ALIN instruments	From 1/1	XLIN

A segment address is derived directly from a node address by setting the segment to the top 4 bits of the node address (e.g. node address 43 becomes network address 0443). This restricts the number of logical segments on a network to 16 which means that no more than 16 physical segments are permitted. Instruments using the original LIN protocol (LIN) ignore any segment information. Instruments using the extended LIN protocol (XLIN) derive the segment address for any network address they see, thus databases created by existing configurators or requests from existing LIN instruments are modified automatically when directed to an XLIN instrument.

All instruments, including T221s, interconnected on LIN and ALIN must have unique addresses in the range 01 to FE. Addresses 00 and FF are forbidden.

The following rules should be observed when designing a multi-segment network:

- Messages to and from instruments using the original LIN protocol (LIN) can only pass through 1 bridge (1 hop). Messages to and from instruments using the extended LIN protocol (XLIN) may pass through up to 8 bridges (8 hops), although for efficiency, the number of hops should be kept to a minimum.
- XLIN and LIN protocol instruments will coexist. The XLIN instruments spot instruments using the original LIN protocol and send messages in that format. The T221 bridge translates XLIN messages from ALIN instruments into the original format if required.
- When communicating between instruments using the original LIN protocol (LIN) and ALIN instruments the bridge address must be within the same group as the instrument addresses, e.g. to communicate with ALIN instrument addresses 40-4F, the bridge address must be 4x (where 4x is a spare address in the range 40-4F).
- Logical segments must not be split over more than one physical cable. If this happens, bridges will report split segments and communication from one node to another may be affected.



- It is permissible for more than one logical segment to reside on a single physical cable. Thus a single cable with instruments at addresses 11, 43 and FA will have three logical segments 01, 04 and 0F.
- An arbitrary network topology with multiple paths between any two nodes is permitted, subject to the restrictions on the number of hops noted above. The bridges generate, maintain and distribute routing information and the end nodes and bridges use this information to choose the shortest route between two points for message transmission.

### Module redundancy

Redundant bridges between two segments are permitted. For original LIN protocol messages, each bridge forwards messages for instruments in its LoListen - HiListen range. For extended XLIN protocol messages, the instruments choose which bridge to use based on their internal routing tables. The following table indicates how LoListen and HiListen are defined for various combinations of bridge:

1 bridge		
Bridge address	LoListen	HiListen
45	40	4F
2 bridges		
Bridge address	LoListen	HiListen
41	40	47
48	48	4F
3 bridges		
Bridge address	LoListen	HiListen
40	40	44
45	45	4B
4C	4C	4F

It is recommended that redundant T221s are set to the lowest two addresses in a group, ie x0 and x1.

Transient communications (software) alarms may be generated as T221s go on- and off-line.

### LIN kill feature

A special mechanism has been built into T221 to overcome a problem which causes failure of communication from old transport instruments through redundant bridges when the ALIN connection to one bridge is broken.

The fault is a consequence of the requirement for T221 to work with old transport instruments which do not recognise the presence of a bridge. These instruments rely on the T221 to do the routing so for instance if QLIN wants to talk to T640 address 41 through bridges at addresses 40 and 48, the bridges agree amongst themselves which will handle the requests. This is done by spotting the address of the other bridge on LIN and setting 'LoListen' and 'HiListen' values - in the example bridge 40 will forward 40-47, bridge 48 will forward 48-4F. If bridge 40 loses its ALIN connection, it still picks up messages to 41, but is unable to forward them. This situation persists until either T221 address 40 is removed or its ALIN connection is mended.



The LIN kill feature overcomes this problem by testing for a redundant T221 with a faulty ALIN connection and shutting down that T221's LIN to allow the other T221 to take over the communication. The LIN and ALIN fail LEDs on the front panel both flash to indicate a fault and the terminal configurator is still operational for further diagnosis of the problem.

Two of the switches are used to control the operation of this feature. SW1-5 is used to enable the feature - if off, the feature is disabled. SW1-6 is used to define the recovery method - if off, LIN is automatically restored when ALIN is restored, if on, the T221 has to be manually reset by cycling the power in order to restore the LIN.

Diagnostic information on the state of the feature is available in the T221 Root block. The two switches are identified in the SW\_2&1 field, and the "Kill state" is available in bit 3 of the options field - FALSE = LIN operational, TRUE = LIN killed.

*Note - This feature should be used with great care and only enabled on systems which have redundant T221s and at least one instrument which does not support the extended LIN addressing feature.*





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