WESTINGHOUSE rail systems

STANDARDS LIBRARY

IB 179

WARNING: This Manufacturer's Manual is not for use on Network Rail commissionings.

See RT/E/PS/11756.

continue to document

F1

GEC ALSTHOM

TRANSPORT

RESEARCH & DEVELOPMENT DEPARTMENT, MANCHESTER

IB179

COMMISSIONING INSTRUCTION

FOR

GEC ALSTHOM HIGH VOLTAGE IMPULSE TRACK CIRCUITS

GEC ALSTHOM SIGNALLING LIMITED
Borehamwood Industrial Park, Rowley Lane, Borehamwood, Herts WD6 5PZ England
Telephone: 081 953 9922, Fax: 081 207 5905, Telex: 916129 GAS G
Registered in England No.2503799. Registered Office as above address

Contents

1. Principle of Operation

1.1. Rail Voltage Waveform

The High Voltage Impulse Track Circuit operates by applying a short high voltage impulse to the rails at relatively long intervals. A typical feed end rail voltage waveform is shown in fig. 1.1.

1.2. Feed End

The impulse is generated by charging a capacitor up to a high voltage and then discharging it through a thyristor and matching transformer into the track. The inductance of the feed and relay end transformers together with that of the rails cause the positive-going pulse to be followed by a negative-going "undershoot" of lower amplitude, thereby giving rise to the waveform characteristic of this type of track circuit.

1.3. Relay End

At the relay end, the rail voltage is rectified and drives the track relay. The positive-going and negative-going parts of the waveform are rectified separately and applied to different windings on the relay. This has a special magnetic circuit which ensures that the relay can only pick up if the applied voltages are in the correct ratio, i.e. the track waveform is correct.

1.4. Traction Immunity

Since the receiver is transformer coupled it cannot be energised by DC from the track.

AC traction interference will generally have a symmetrical waveform (except under transient conditions). When rectified in the receiver this will not have the correct ratio of positive to negative voltage swing and so cannot energise the track relay.

1.5. Rail Head Contamination

The high peak voltage (up to 150V) generated by the feed end ensures that shunting of the HVITC is unlikely to be affected by rust, leaves, coal dust, or other contamination of the rail head.

1.6. Polarity Stagger

Since the track waveform is asymmetrical, protection against IBJ failure can be obtained by connecting adjacent track circuits with opposite polarities.

1.7. Rail Voltage Measurements

Due to the pulsed nature of the rail voltage it is not possible to measure it directly using an ordinary multimeter. It is necessary to use a rectifying circuit which responds to the peak value of the voltage waveform. This is available as the "integrator" type BMC and is used in conjunction with a multimeter. Depending on the polarity of the rail connections this will indicate either the positive or the negative peak voltage.

2. SPECIFICATION

2.1. Track Circuit Length

Different maximum lengths and drop shunts are specified by BR (for use on BR) and by ALSTHOM. The minimum ballast resistance is 2Ω.km.

		Drop Shunt	Electrification			
			AC	DC	Dual	None
Max. t/c length	BR	1·0Ω	300m	200m	200m	-
		0·5Ω	-	-	-	1200m
	ALSTHOM	0·5Ω	400m	500m	-	1200m

2.2. Tail Cables

		Feed End		Relay End	
		Max. Length	Max. Res.	Max. Length	Max. Res.
BR		500m	8Ω	500m	8Ω
ALSTHOM	Electrified	2000m	20Ω	2000m	60Ω
	Non-electrified	2000m	60Ω	2000m	60Ω

2.3. Power Supply

The feed end requires a 110VAC power supply at 50W. The relay end is unpowered.

2.4. Pulse Repetition Frequency

The standard transmitter operates at 3pps.

3. Units Comprising Track Circuit

3.1. Feed End, Electrified lines

NCO EAT 115 CA	Power Supply Unit 110V, 50Hz
NCO EGT 600	Transmitter for AC and dual electrified lines
NCO EGT 600P	Transmitter for DC electrified lines
TVTH1	Track Transformer
ER 2.2	Resistance (DC and dual electrified lines only)

The block diagram is shown in fig. 3.1.
NOTE: Transmitter EGT600P is similar to EGT600 but incorporates protection against interference from certain kinds of DC tracion system. It must not be used on AC or dual electrified lines.

3.2. Feed End, Non-electrified Lines

NCO EAT 115 CA	Power Supply Unit 110V, 50Hz
NCO EGT 600	Transmitter
RK 40 0 0.7	Resistance
TVTHD2	Track Transformer

The block diagram is shown in fig. 3.2.

3.3. Relay End, Electrified Lines

ER 2.2	Resistance (DC and dual electrified lines only)
TVTH1	Track Transformer
NCO RVT 600	Receiver
NCO CV TH 2.4.0.4	Track Relay

The block diagram is shown in fig. 3.3.

3.4. Relay End, Non-electrified Lines

TVTHD2	Track Transformer
NCO RVT 600	Receiver
NCO CV TH 2.4.0.4	Track Relay

The block diagram is shown in fig. 3.4.

3.5. Installation

Units prefixed "NCO" are constructed in the "NS1" style which is the French equivalent of the BR930 series miniature relay construction, but permits different size modules.

Track transformers are installed at the trackside adjacent to the block joints.

3.6. Outline Diagrams

The outline diagrams are shown in figure nos. as follows:-

NCO EAT 115 CA	Fig. 3.6.1
NCO EGT 600	Fig. 3.6.2
TVTH1	Fig. 3.6.3
TVTHD2	Fig. 3.6.4
ER 2.2	Fig. 3.6.5
RK 40 0 0.7	Fig. 3.6.6
NCO RVT 600	Fig. 3.6.7
NCO CV TH 2.4.0.4	Fig. 3.6.8
BMC	Fig. 3.6.9

4. SETTING-UP PROCEDURE

4.1. Electrified Lines

In this application the only adjustment required is the loop resistance of the tail cable between the transmitter and its track transformer. This is set to a total of 20Ω when transformer TVTH1 is used.

The output resistance tappings on the transmitter EGT 600 are to be set as follows:-

Tail Cable Length (m)	Resistance of 50/0·25	Transmitter Terminal Connections
0-120	2Ω	C+ to 6
120-240	4Ω	C+ to 5
240-360	6Ω	C+ to 5 AND 2 to 3
360-500	8Ω	C+ to 6 AND 3 to 4

When the transmitter connections have been checked and adjusted if necessary the feed end may be energised. The 3Hz pulse should be audible.

4.1.1. Rail Voltage

To measure the rail voltage the integrator type BMC must be used together with a high impedance multimeter. The reading obtained will depend on the polarity of the rail connections.

Where track transformer TVTH1 is used the higher (+ve) voltage should be in the range 50-150V. The lower (-ve) voltage should be 8-22V.

4.1.2. Relay Voltages

The relay coil voltages may be measured directly using the multimeter. Between terminals V1+ and V1- the voltage should be in the range 22-50V; between terminals V2+ and V2- it should be in the range 30-80V.

4.1.3. Drop shunt

Measure the drop shunt at the relay end. This must be greater than 1·0Ω and less than 3·0Ω.

4.2. Non-electrified Lines

The loop resistance of the tail cable between the transmitter and its track transformer is to be set to 60Ω when transformer type TVTHD2 is used. This is achieved by the combination of transmitter output tappings (up to 19Ω) and adjustable resistance type RK 40 (up to 40Ω).

The output resistance tappings of the transmitter NCO EGT 600 are as follows:-

Terminals	1-2	2-3	3-4	4-5	5-6
Resistance	5Ω	2Ω	5Ω	5Ω	2Ω

In this application the receiver sensitivity is adjusted according to the track circuit length (see fig. 3.4.):-

T/c length	Connections between Receiver & Track Txfmr
18 to 600m	C+ to A C1- to B
600 to 1200m	C+ to A C1- to C

4.2.1. Rail Voltage

Where track transformer TVTHD2 is used the higher (+ve) rail voltage should be in the range 8-94V. The lower (-ve) voltage should be in the range 0·8-8V.

4.2.2. Relay Voltage

Between relay terminals V1+ and V1- the voltage should be in the range 12-43VDC; between terminals V2+ and V2- it should be in the range 22-90VDC.

4.2.3. Drop shunt

Measure the drop shunt at the relay end. This must be greater than 0·5Ω and less than 2·0Ω.

5. Fault Finding

5.1. Test Equipment

Integrator type BMC
High impedance multimeter
Shunt box

WARNING: The power supply and the output voltages of the transmitter EGT 600 have peak values in excess of 600V. These voltages MUST NOT be measured without appropriate safety precautions. The following fault finding procedure does not require such measurements.

5.2. Measurement of Impulse Voltages

The impulse waveform is of very short duration compared to its repetition period and so its amplitude cannot be measured directly with an ordinary meter. The integrator type BMC incorporates a diode and capacitor network which stores the peak value of the voltage waveform enabling it to be displayed by the meter. To obtain the correct results the meter must have a resistance of at least 10kΩ/volt; all electronic multimeters will meet this but some models of AVO may not.

Both positive and negative peaks should be measured because they must be in the correct ratio - about 5:1 - to operate the track relay. The limits are given in the setting-up procedure, section 4.

5.3. Measurement of Feed End Output Current

Connect the shunt box across the rails at the feed end and set it to 0·5Ω. Measure the positive peak voltage voltage across the rails using the BMC integrator and a multimeter. This should be greater than 50V.

Note that the receiver sensitivity will be affected if the transmitter pulse repetition rate is incorrect. This can be checked by counting the number of pulses in say 5 seconds; there should be between 14 and 16.

5.4. Measurement of Transmitter EGT 600 Output Current

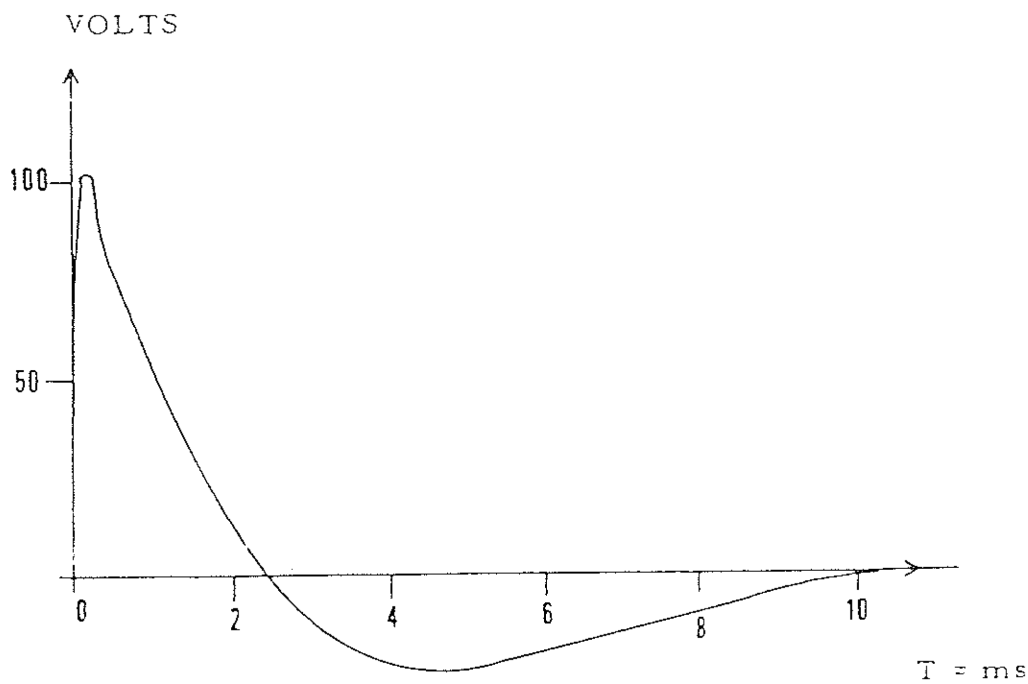
This may be measured "off line" by connecting terminal C- to terminal 6 and measuring the voltage between terminals 1 and 3 using the BMC adaptor and multimeter. Any other links between terminals 1 to 6 should be temporarily disconnected. The peak voltage should be greater than 120V. Note the transmitter should not be operated for more than about 2 minutes in this configuration.

5.5. Fault Finding

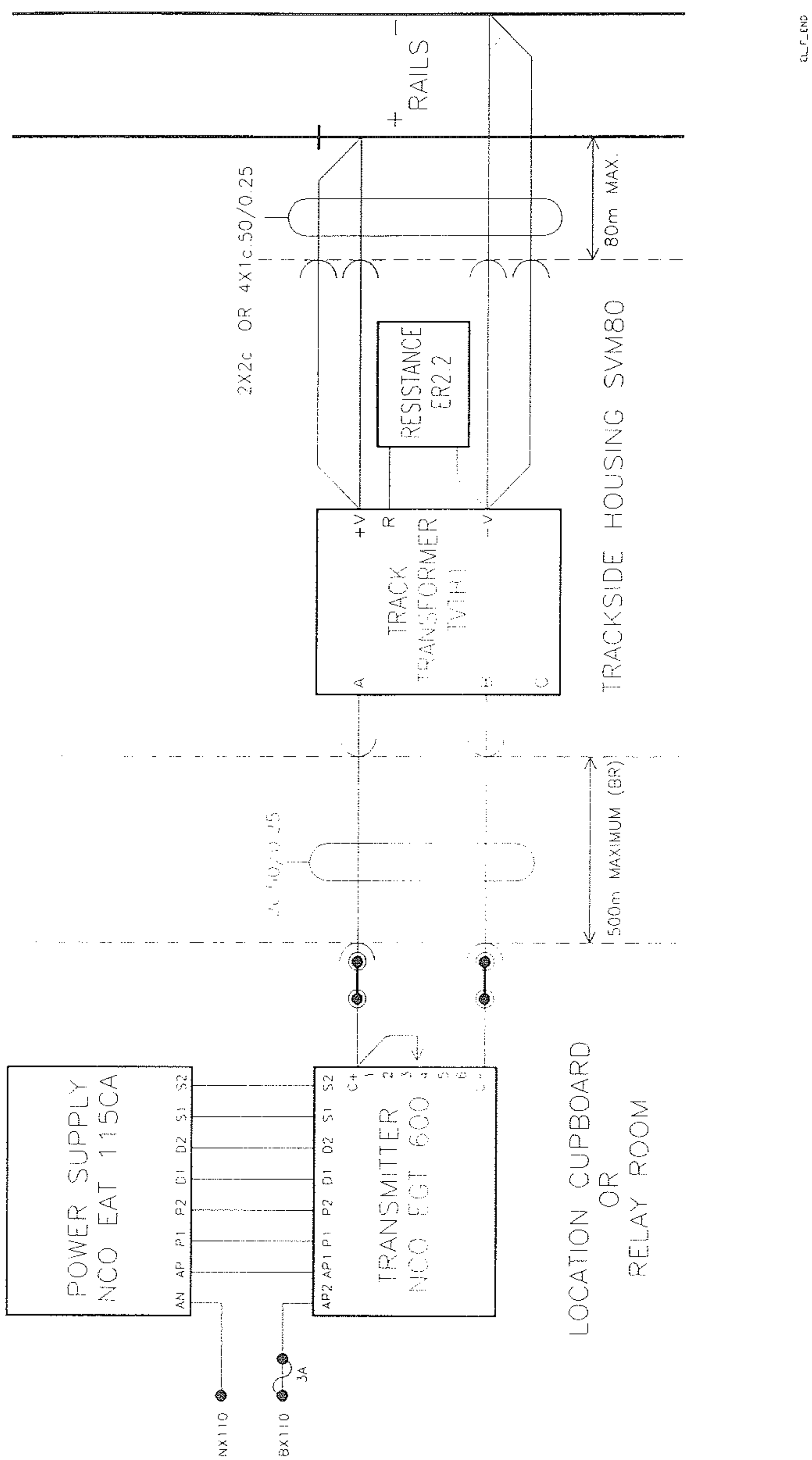
The procedure shown in fig. 5.5. may be used as a guide. When the fault has been corrected the drop shunt of the track circuit must be checked as described in section 4 and recorded on the record card.

The integrator type BMC is provided with an output for a loudspeaker or earphone. This may be used to assess the strength and/or frequency of the impulses and hence to locate open/short circuits or faulty transmitters.

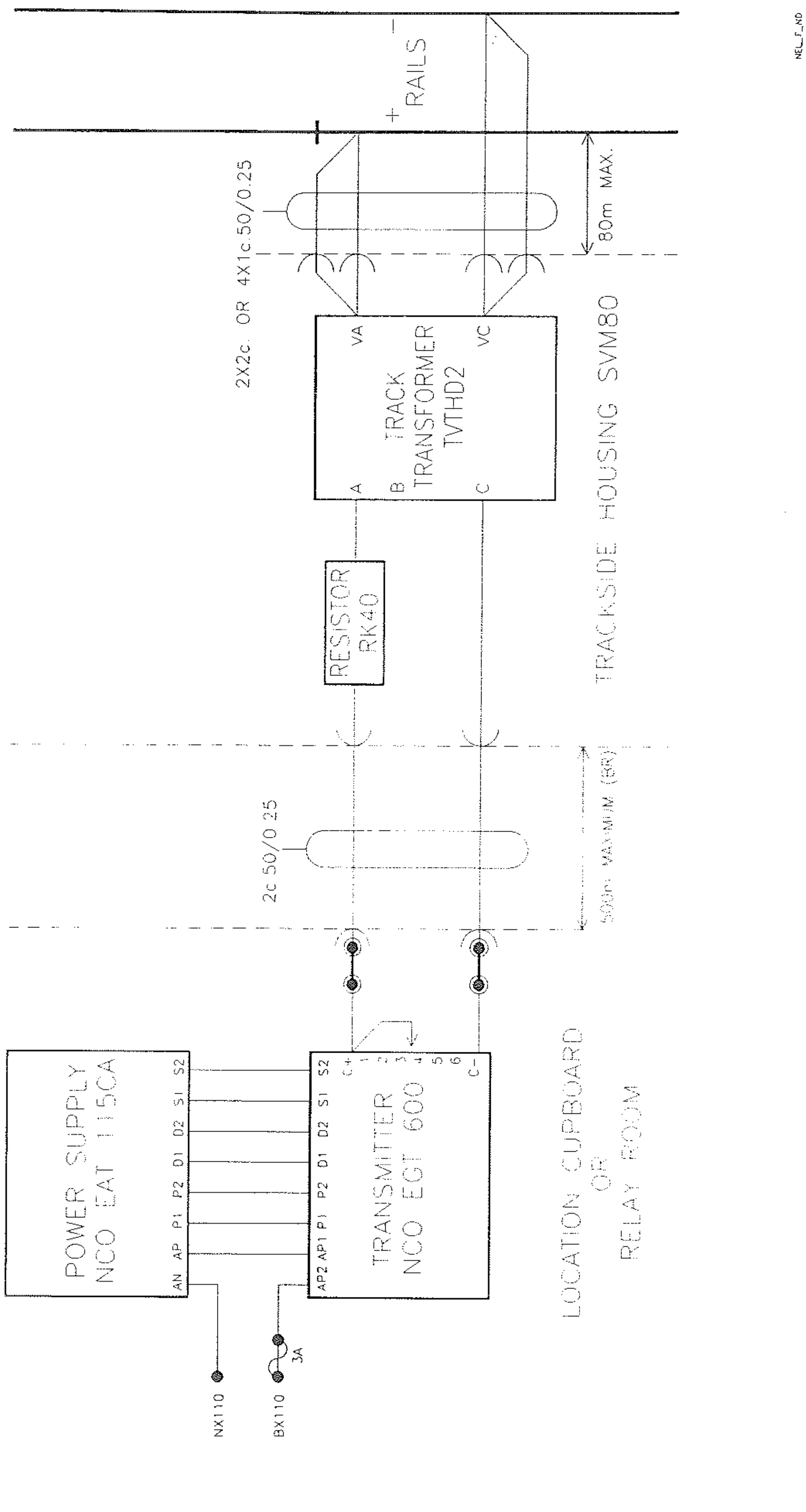
NOTE: Polarity of connections in the signal path between transmitter and receiver must be observed. If the polarity is reversed the track relay will not pick up.



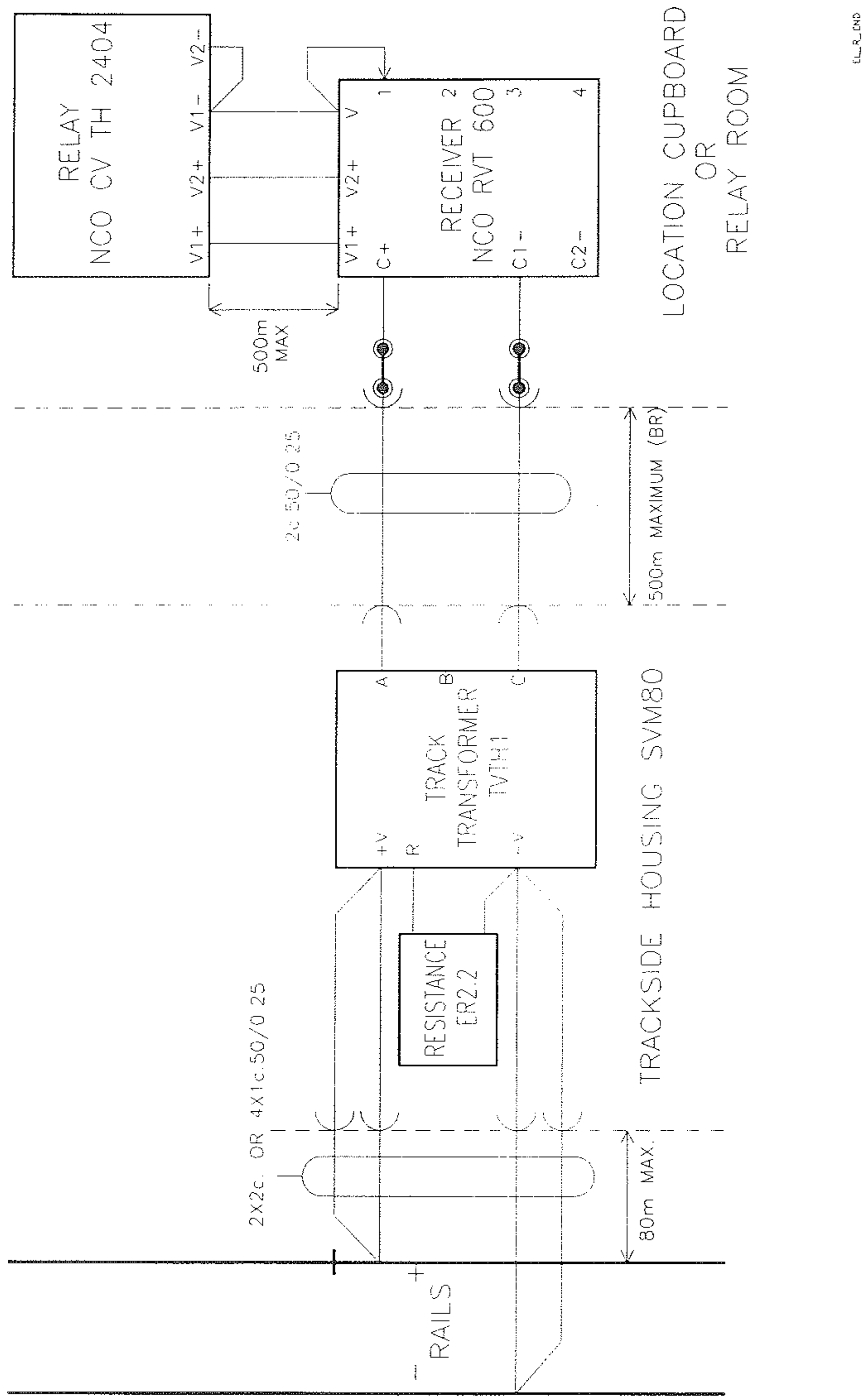
IB179 Page 11 Fig. 1.1. Typical Track Voltage Waveform



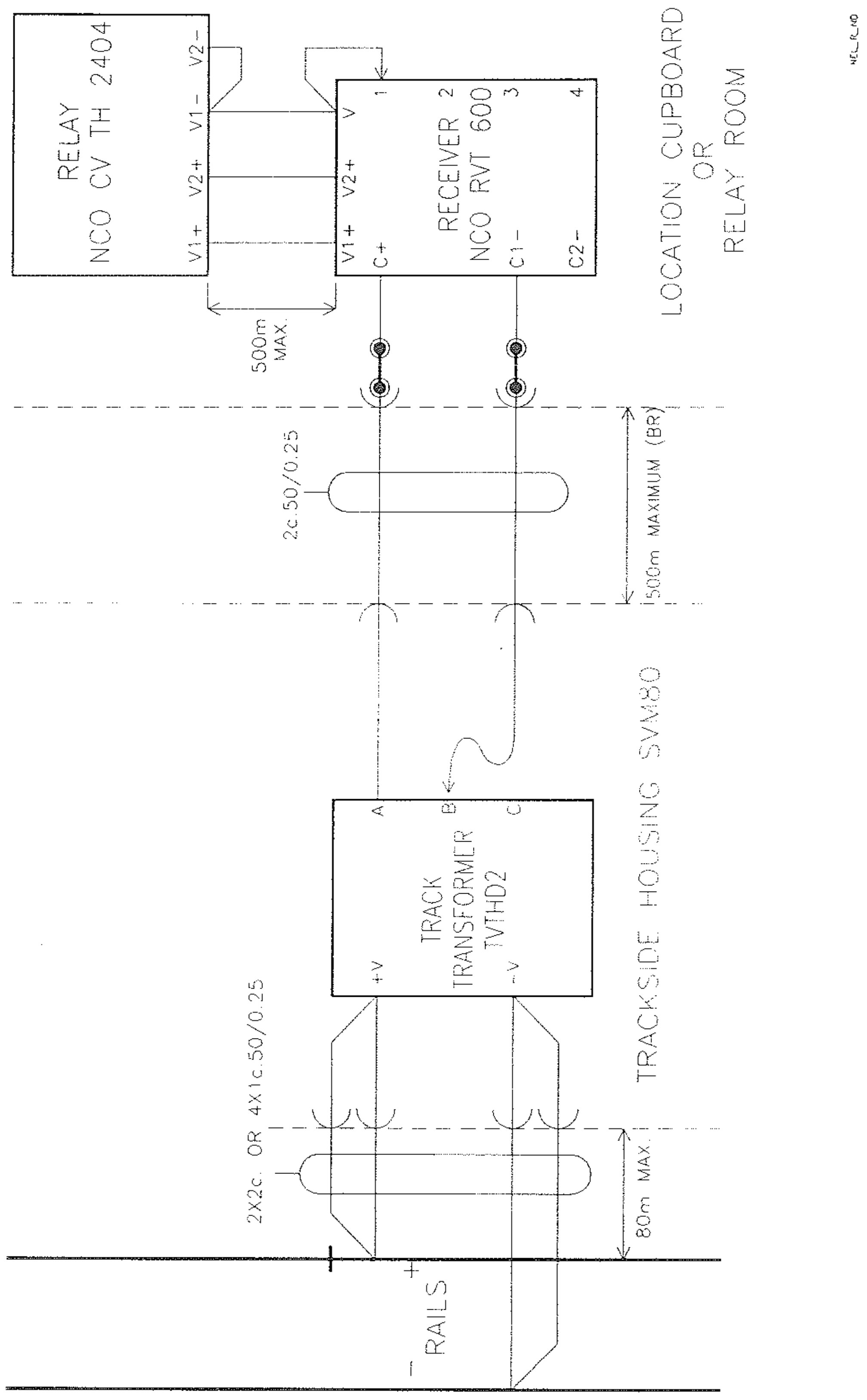
IB179 Page 12 Fig. 3.1. Feed End for Electrified Lines



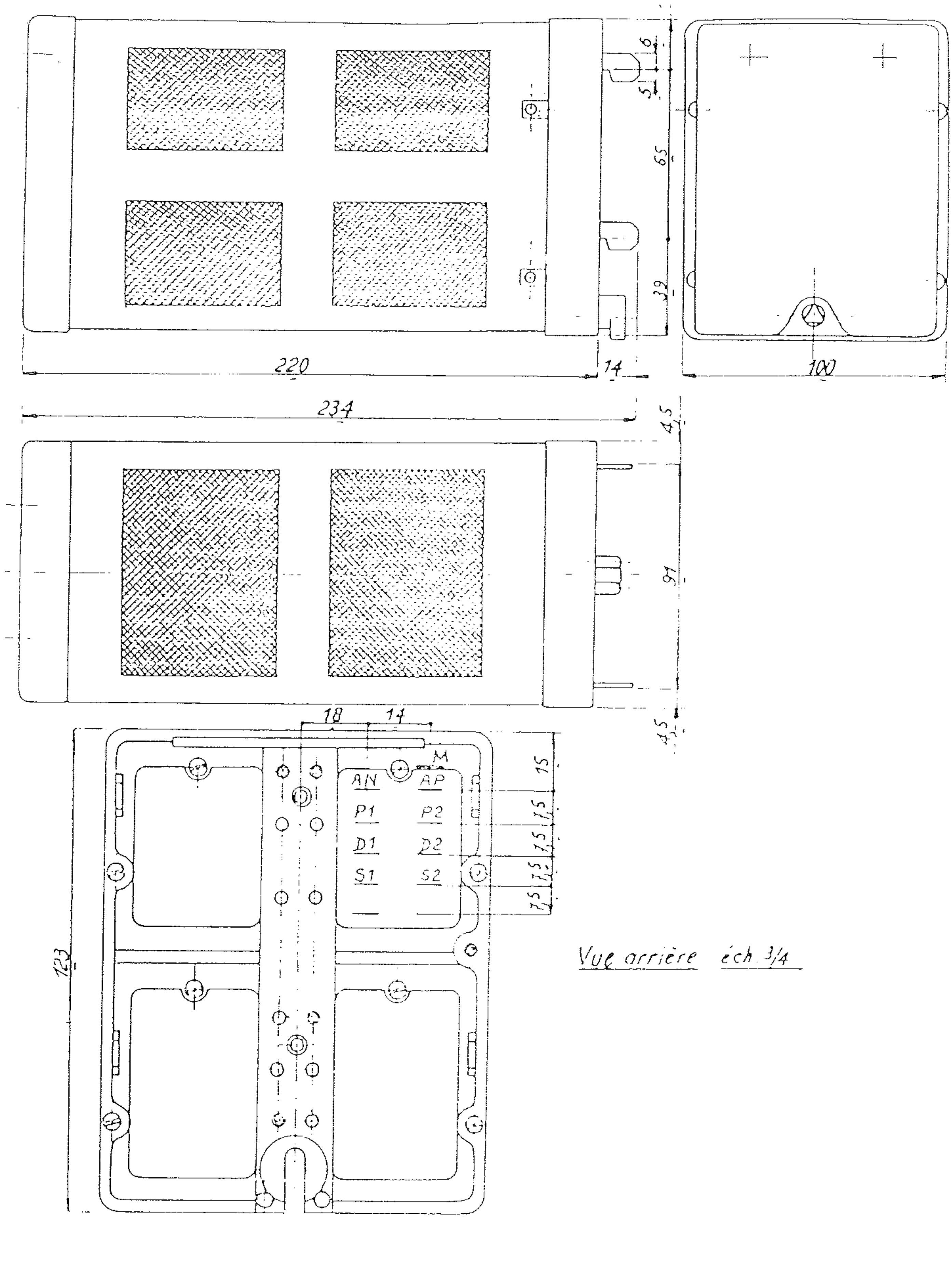
IB179 Page 13 Fig. 3.2. Feed End for Non-electrified Lines



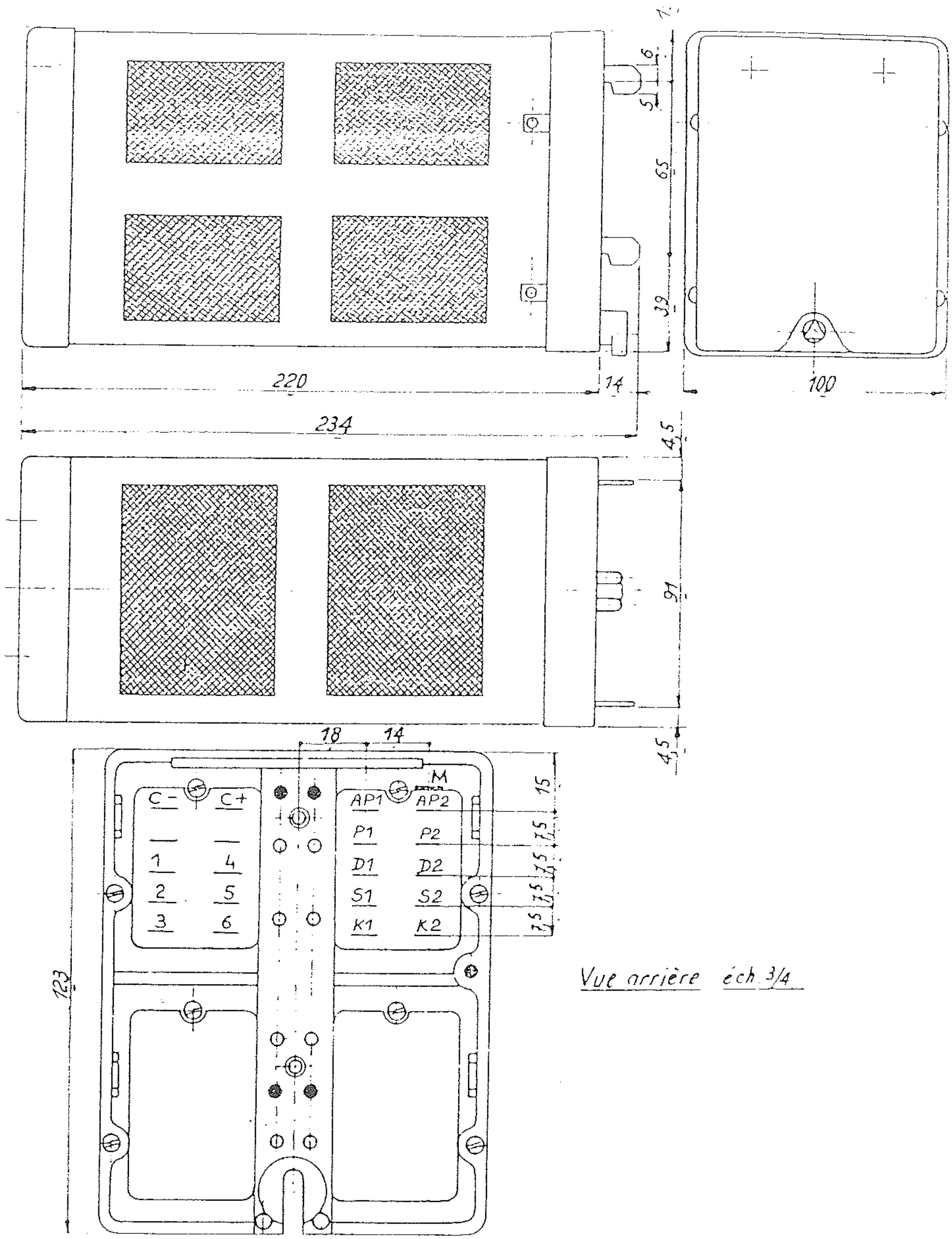
IB179 Page 14 Fig. 3.3. Relay End for Electrified Lines



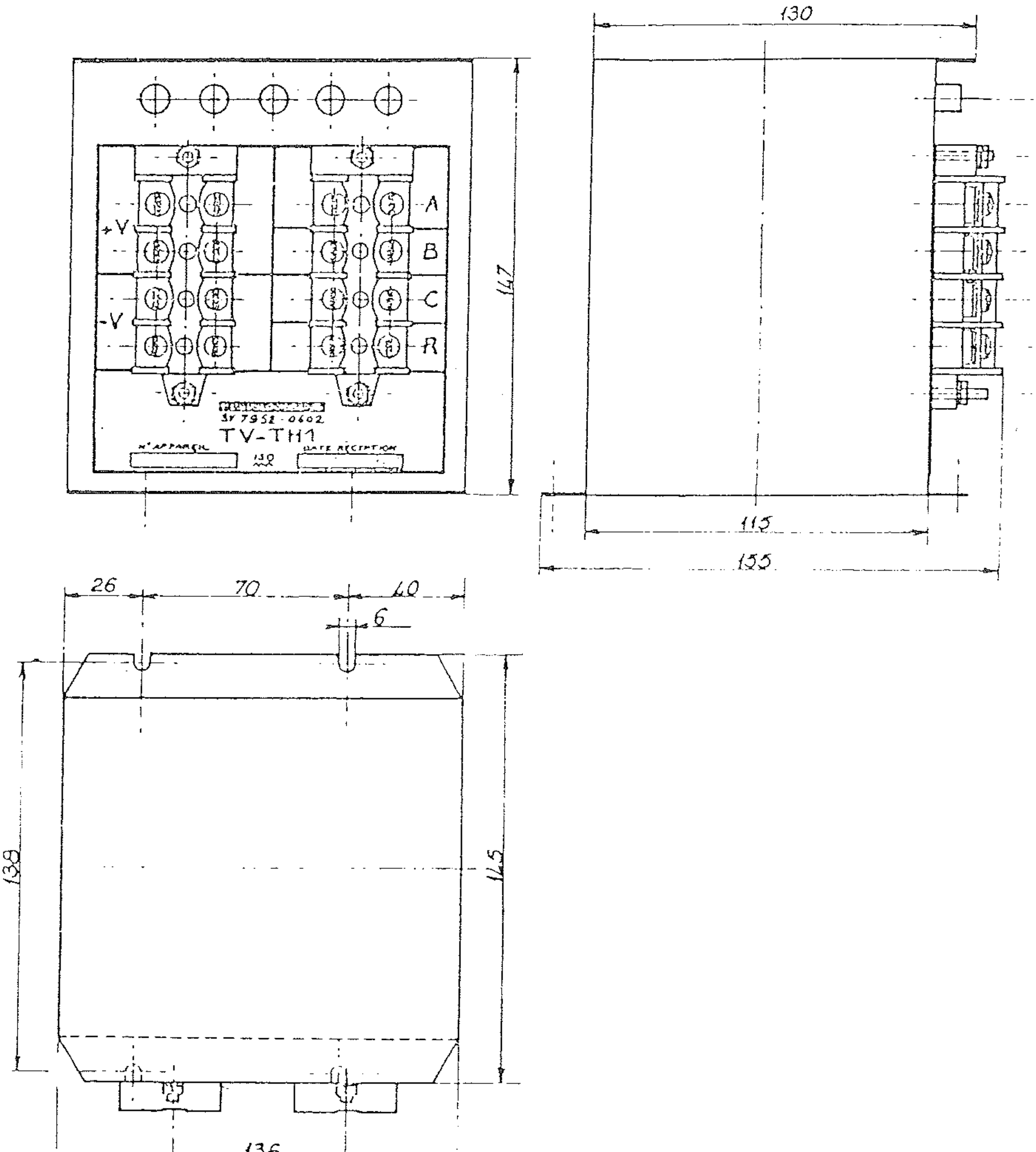
IB179 Page 15 Fig. 3.4. Relay End for Non-electrified Lines



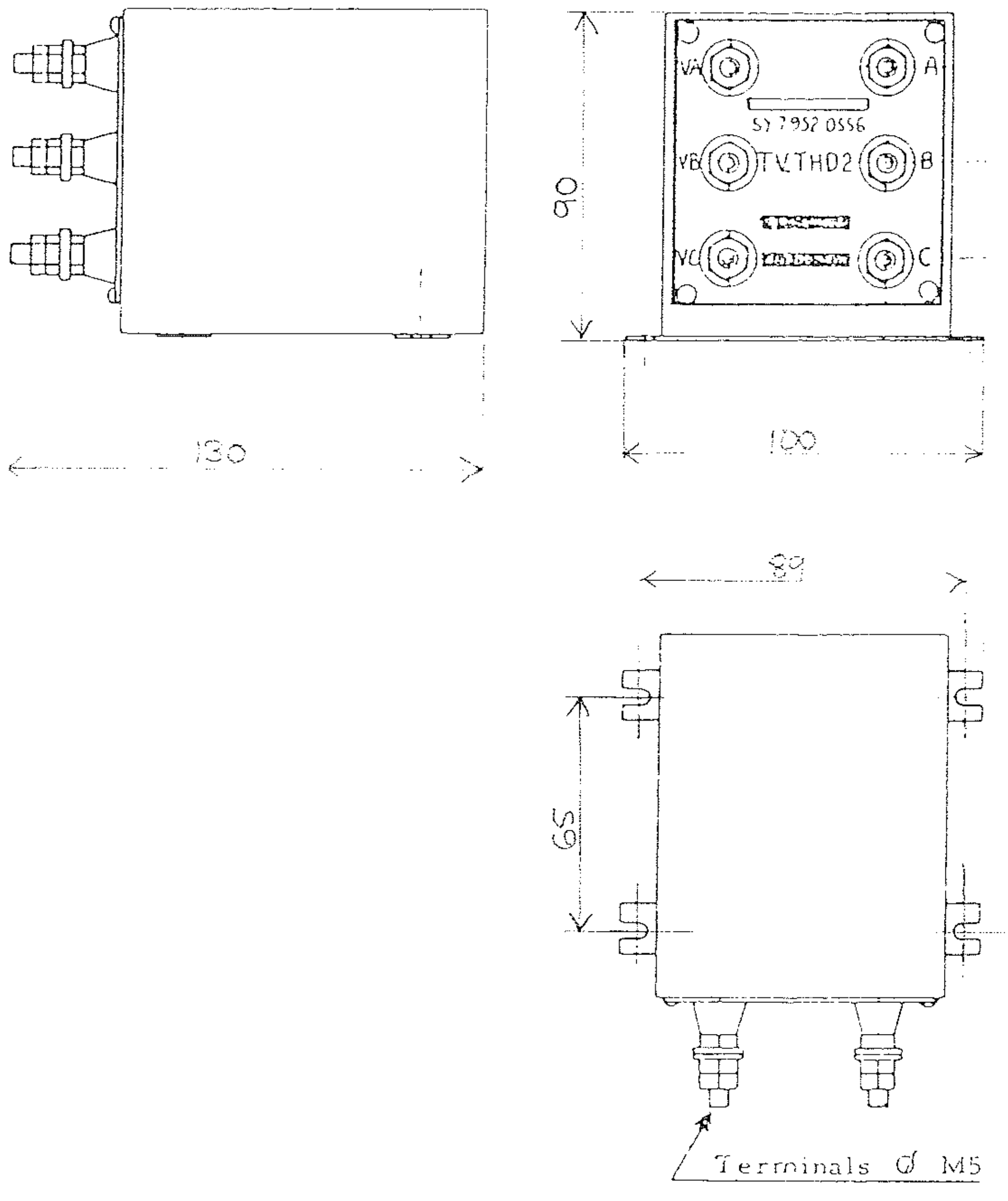
IB179 Page 16 Fig 3.6.1. Outline Drawing of Power Supply Unit type NCO EAT 115 CA



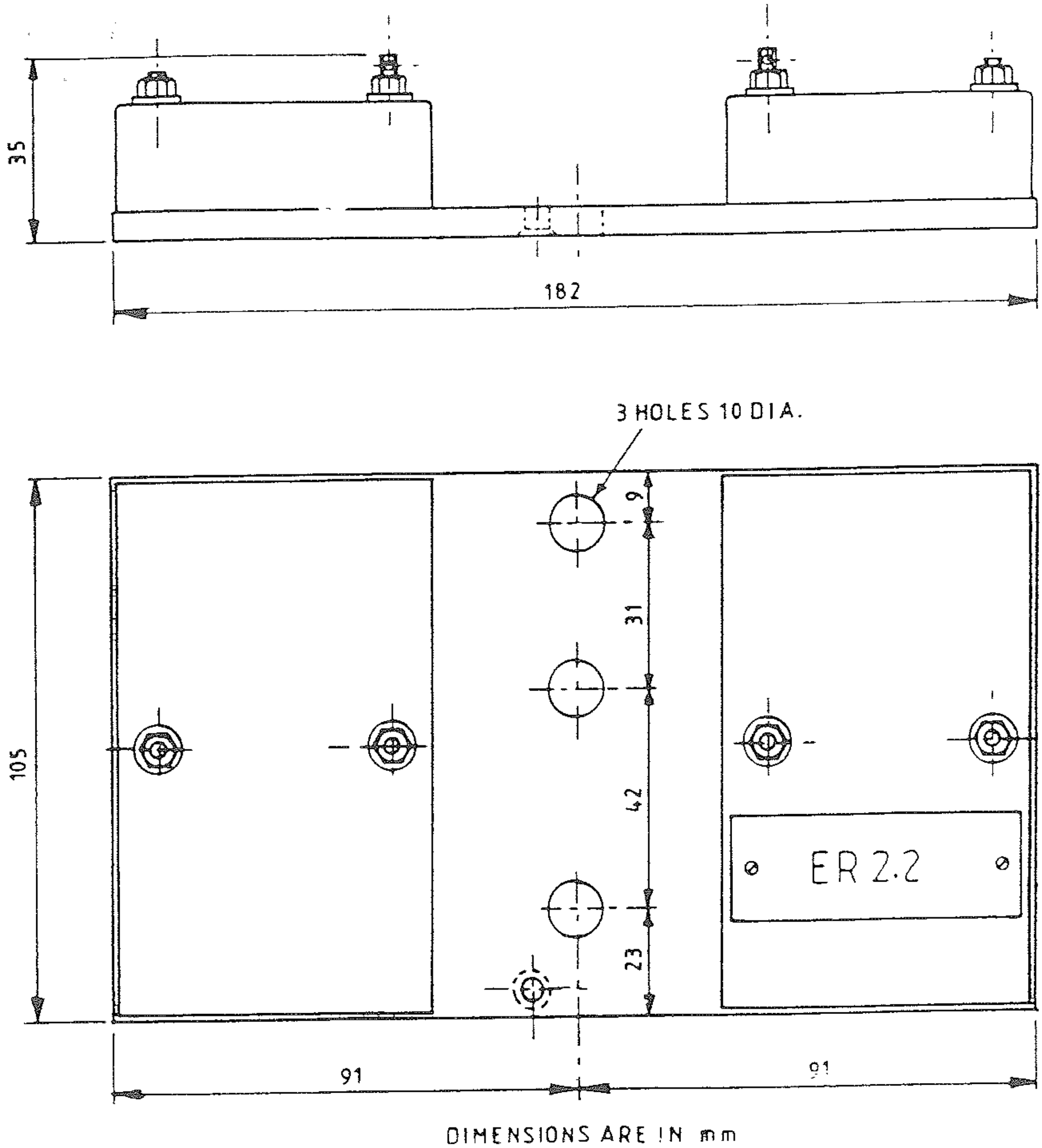
IB179 Page 17 Fig. 3.6.2. Outline Drawing of Transmitter
type NCO EGT 600



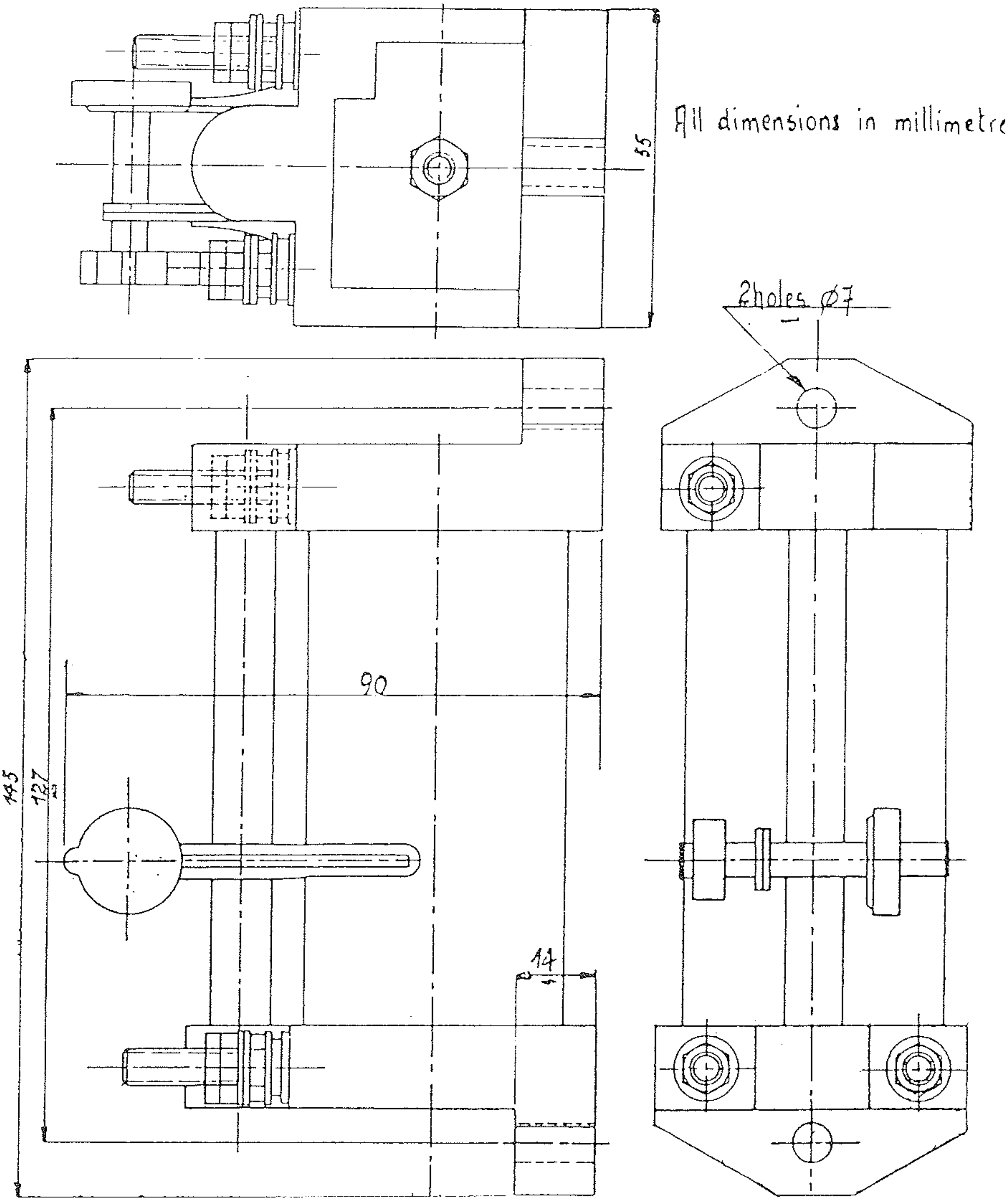
IB179 Page 18 Fig. 3.6.3. Outline Drawing of Track Transformer type TVTH1



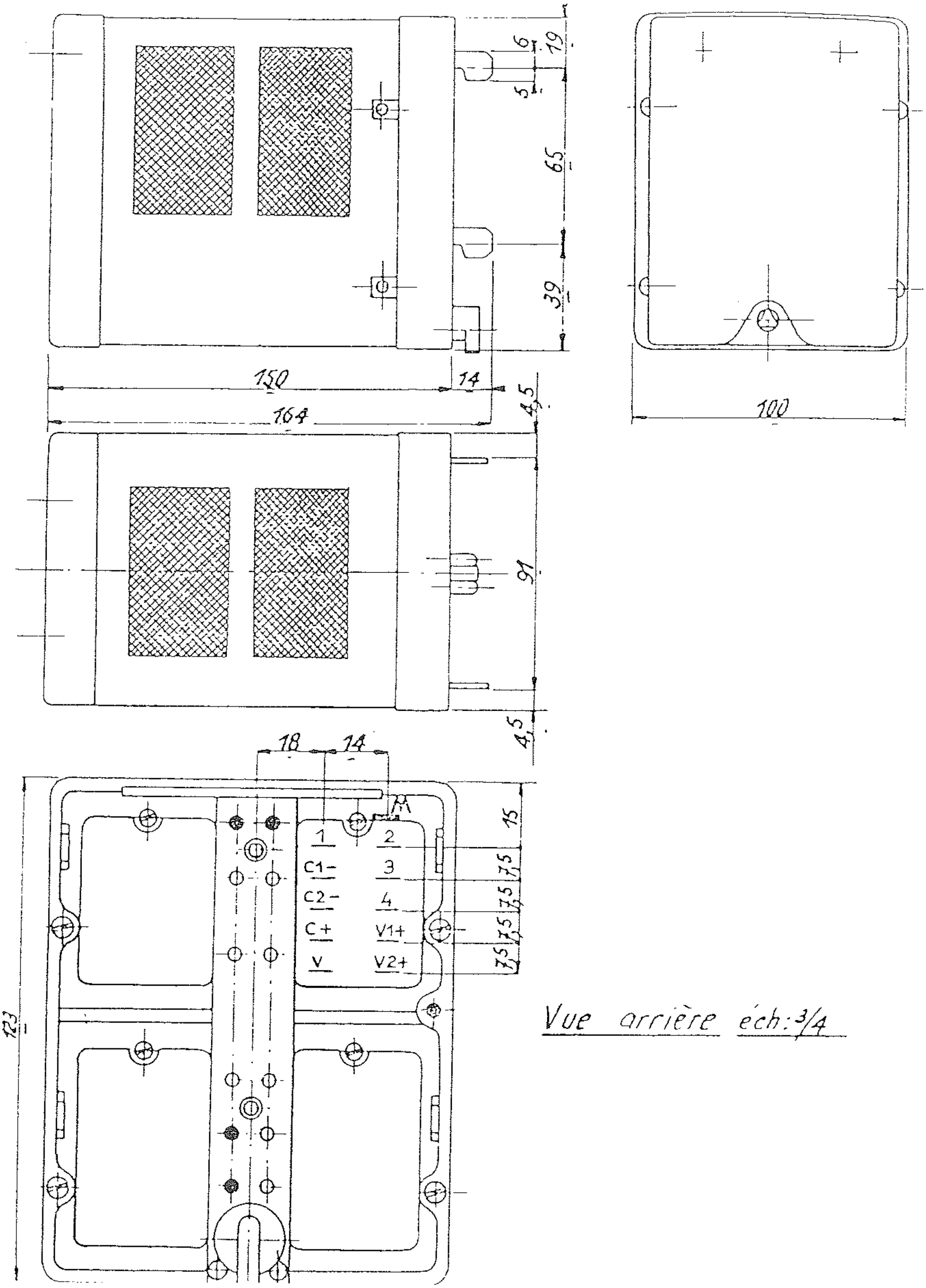
IB179 Page 19 Fig. 3.6.4. Outline Drawing of Track Transformer
type TVTHD2



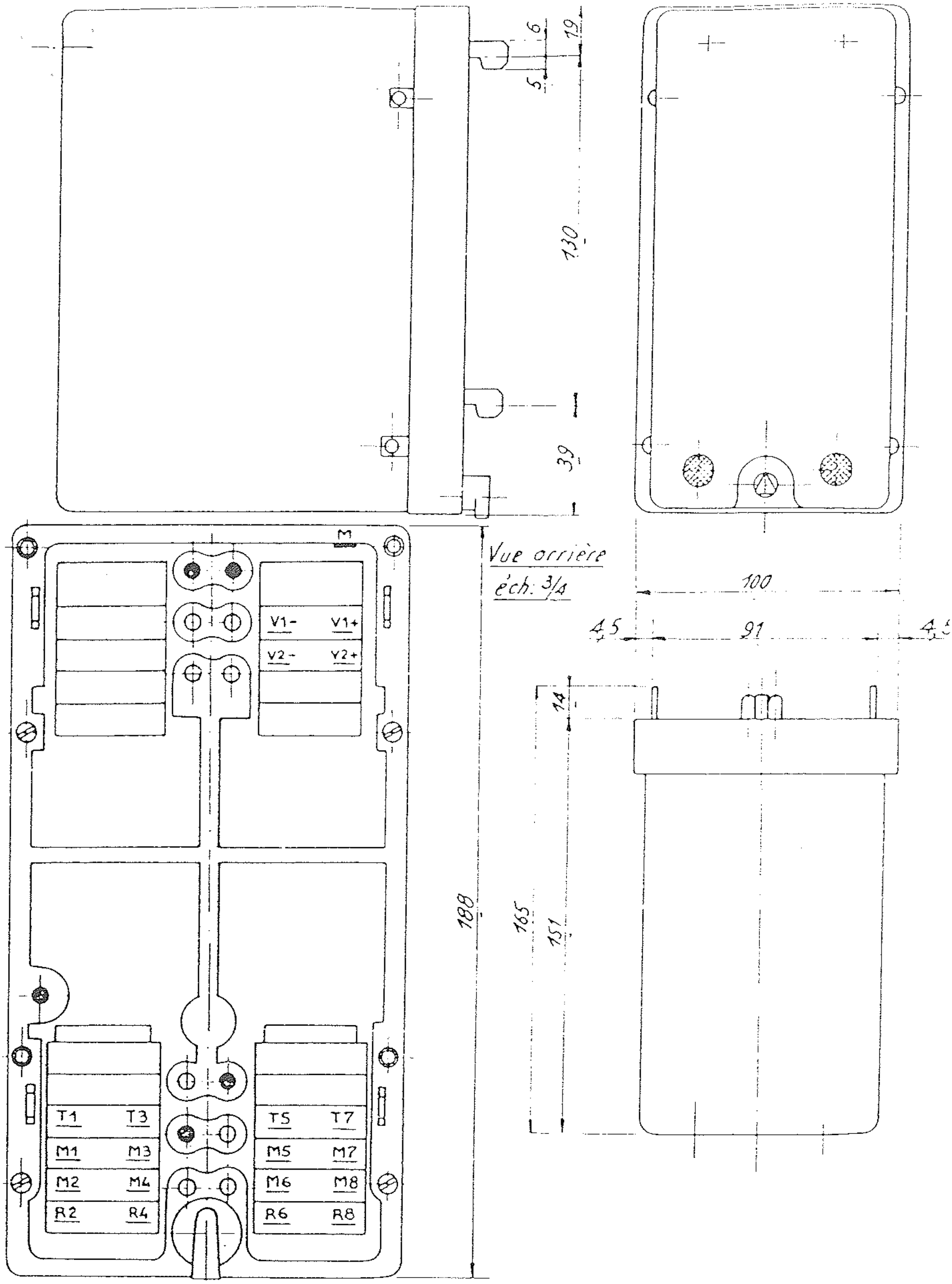
IB179 Page 20 Fig. 3.6.5. Outline Drawing of Resistance Unit type ER 2.2



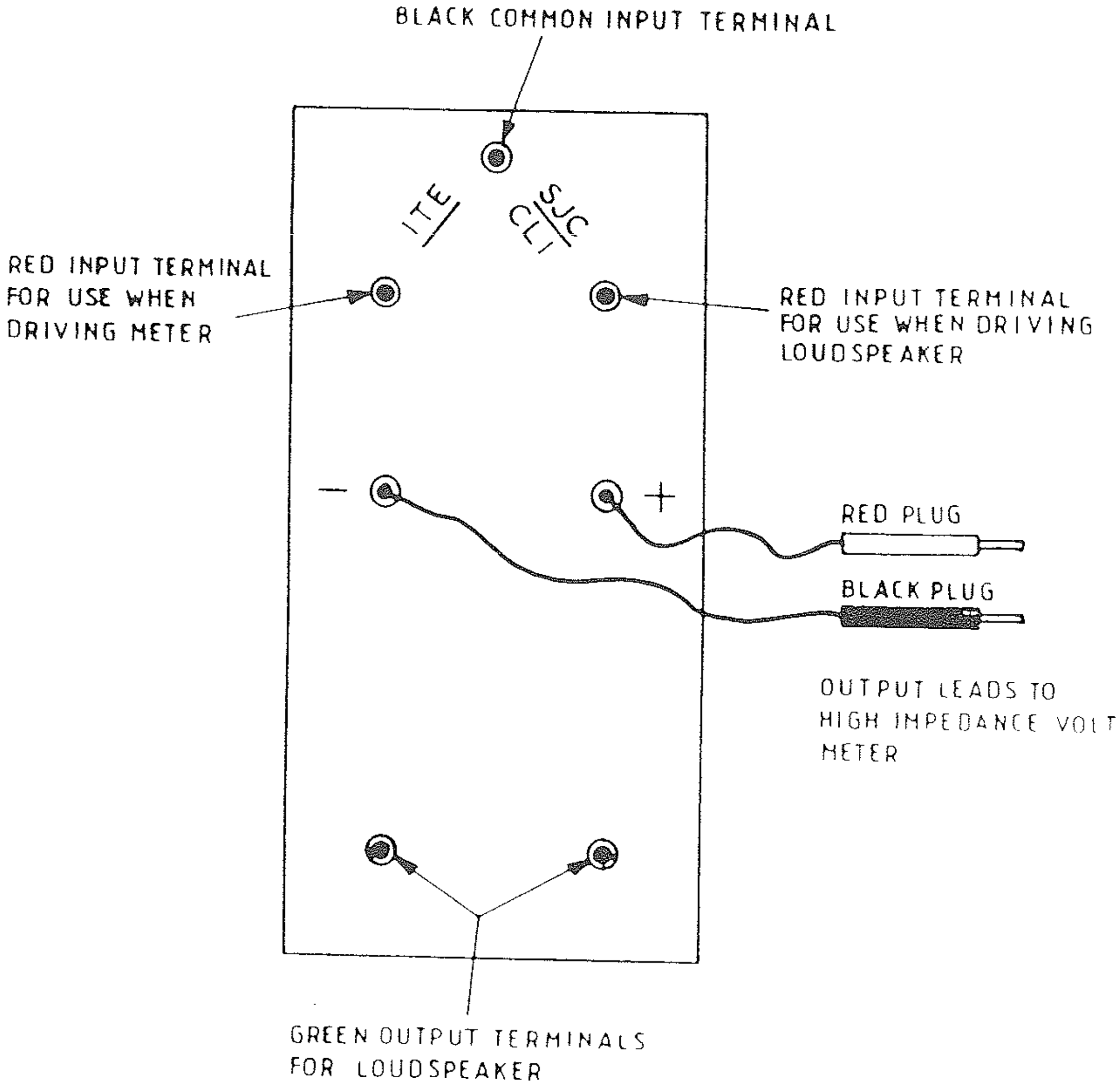
IB179 Page 21 Fig. 3.6.6. Outline Drawing of Variable Resistance type RK 40



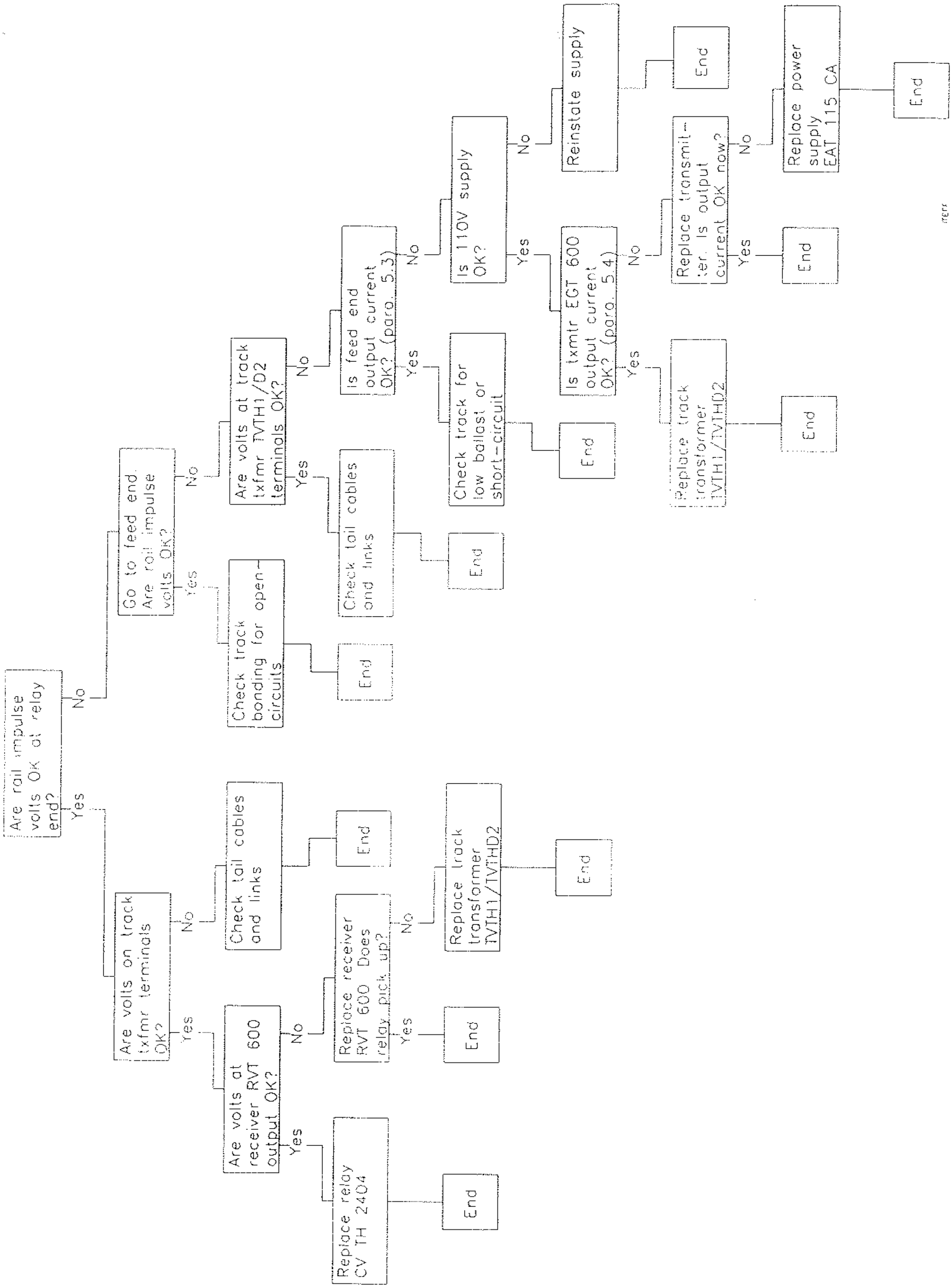
IB179 Page 22 Fig. 3.6.7. Outline Drawing of Receiver
type NCO RVT 600



IB179 Page 23 Fig. 3.6.8. Outline Drawing of Track Relay type NCO CVTH 2.4.0.4.



IB179 Page 24 Fig. 3.6.9. Outline Drawing of Integrator type BMC



IB179 Page 25 Fig. 5.5. Fault Finding Procedure