P.C.C. EQUIPMENT - TYPE SPS 3-135.

TEST UNITS.

The regulating potentiometers located in the control box allow adjustment of that instruction voltage to the required value at the maximum and minimum positions of depression of the pedal used.

The circuits forming the motor current instruction in traction and in braking are totally independent of one another and the choice of the instruction to be used is achieved by a reverser micro-relay, the coil of which is energised by the signal directing closing of the traction relay of the power equipment.

Micro-relay de-energised = braking current instruction

Micro-relay energised = traction current instruction.

3. Motor current measure (TR + J4)

The motor current measure voltage, the image of the current flowing in the traction motors, is obtained from a magnetic transductor (TR) associated with a step-up transformer and an adjustable resistor. This voltage is passed, after rectification, to the acceleration regulator card (J1) and the polarity is negative. The relationship of motor current to measure voltage may be adjusted by a potentiometer located on card J4.

4. Coasting measure.

A tachometric alternator driven by one of the traction motors delivers a voltage proportional to the speed of the vehicle. The current produced by this alternator is rectified and passed to a circuit comprising on the one part the coasting rheostat of the accelerator and on the other part an adjustable resistance of which the voltage at the terminals, used in negative polarity, is called the "coasting measure".

The relationship of coasting current to measure voltage may be adjusted by a potentiometer located on the control box.

5. Coasting monitoring (J4)

An electronic tumbler governed by the coasting measure constantly verifies the presence of that measure and in case of failure of the circuit, blocks the coasting comparator branch of the acceleration regulator card, de-energises the auxiliary coasting monitoring relay (RSD), de-energisation of which causes automatically:-

in free coasting, passage of the equipment to braked coasting coupling (minimum braking)

in series traction, forced transition to series parallel coupli

6. Rheostatic braking current monitoring (J4). A second electroni tumbler, governed by the motor current measure, or by the logic sign 35F, controls feed of the coil of relay LO.

TEST AND MEASURE UNITS.

DESCRIPTION:

The measure unit together with the testing unit permits:

Simulation of the different logic or anolog sequences produced by the vehicle equipment and thus causing the regulator to function without the associated equipment intervening.

Checking the correct functioning of the logic signals produced by the static control unit and used in the equipment during normal operation.

Supplies of +40 V, -40 V and 24 V 800 Hz are taken from the power supply panel PS and 220 V 50 Hz is supplied from the mains.

1. Measure Unit:

This comprises an auto-transformer fed from the 220 V 50 Hz supply and providing a voltage which may be adjusted progressively from 0 to 220 V.

Depending on the position of the selector switch, this adjustable voltage supplies:

(a) The coasting circuit;
(b) The circuit simulating motor current.

(a) Coasting:

This circuit, comprising a step-up transformer followed by a bridge rectifier, feeds into the coasting circuit of the vehicle a continuously adjustable voltage from 0 to about 400 V, representing a vehicle speed of from 0 to about 50 m.p.h.

The output voltage appears across the D4+ and D4- leads and may be measured across the terminals provided for that purpose. Terminals are also provided so that the regulated current may be checked; these terminals must be short circuited when the ammeter is not connected.

(b) Simulation of motor current:

A step down transformer and bridge rectifier feeds direct current to the primary of a magnetic transductor similar to that used on the vehicle. The primary, however, has 500 turns for each turn of the vehicle transductor, so that a primary current of 1 amp has the same effect as 500 amps in the vehicle transductor.

The primary current may be measured with an ammeter connected across terminals provided for that purpose.

The 800 Hz current passing through the transductor secondary passes to the static control unit via the leads MS1 and MS2.

2. Test Unit:

This is assembled from switches, potentiometers and indicator lamps and is designed to be used as follows:

(a) On the vehicle
Set the switch PM to "Vehicle". The end of travel contacts, progression and regression, of the accelerator will perform their normal function in the equipment.

(b) On the test bench
Set the switch PM to "Bench". The pilot motor under test, connected across the black output terminals M+ and M- of the test unit will be fed from the static control unit while the M+ return to tne vehicle is opened.

TEST AND MEASURE UNITS.

To test the anti-slip circuits, resistances of values equivalent to those of the circuits represented must be connected across the terminals "SAND" and "TB", i.e., 5 ohms 8 A across "SAND" (sanders) and 50 ohms 0.8 A. across "TB" (track brake contactor type W50).

The rest of the description is valid for both cases of utilisation.

Switch S places the testing unit in service.

Switches T, F and B V are used to represent different couplings normally realised by the vehicle control equipment and represent the following:

Switches T and F on "0": Leads T and F not fed, hence coasting coupling is simulated.

Switch T on "1": Lead T is fed, hence traction coupling is simulated.

Switch F on "1": Lead F is fed, hence braking coupling is simulated.

Switches F and B V on "1": Leads F and V are fed, hence low speed braking is simulated.

Also, lead 35F controlling the electronic tumbler which monitors rheostatic braking is fed when switch F is at position "0" and switches T and F are interconnected so that closing F cuts off supply to T.

The operation of each of these switches at the same time controls the corresponding green indicator lamp so that the sequenc selected may be seen at a glance.

Finally, switches K and L, connected in series with the ends of travel leads to the accelerator allow simulation of this function without need for the accelerator to run through its full travel.

The combination of switches K and L with PM set to "Vehicle" prevent supply to the pilot motor if the end of travel contacts on the accelerator are not in service.

TEST AND MEASURE UNITS.

White indicator lamps:

The white indicator lamps SAND, TB, LO and SD are fed from the static control unit and indicate operation of the corresponding circuits, thus:

TB : Operation of track brakes.
SAND : Operation of sanders.
LO : Operation of brake monitoring relay.
SD : Operation of coasting monitoring relay.

Simulation of pedal unit "instruction":

Adjustment of potentiometer CS+ provides a voltage variable from 0 to about +14 V at the CS+ output lead. This voltage may be measured at the instruction measuring terminals of the unit.

Negative "measure":

Adjustment of potentiometer MS- provides a voltage from 0 to -10 V at the MS- output terminal. This voltage may be measured at the MS- measuring terminals of the unit.

Slip simulation:

The slip potentiometer provides a variable voltage between 0 and +40 V across the PA+ and PA- leads. This may be measured at the slip measuring terminals of the unit.

Pilot motor current measurement:

A centre-zero ammeter connected across the I PM measuring terminals indicates the current flowing in the pilot motor when switch I PM is in position "1".

P.C.C. EQUIPMENT - TYPE SPS 3 - 135 FOR MIVG

TESTS AND ADJUSTMENTS OF STATIC CONTROL UNIT

TESTS AND ADJUSTMENTS OF STATIC CONTROL UNIT

TEST ON VEHICLE

The printed circuits having been installed, close circuit breaker B6, set the reverser controller to the "on" position, then open circuit breaker B6.

The vibrator starts and supply is fed to the regulator.

Make certain that the pilot motor is not receiving power in positions 1 - 4 of the accelerator (regression limit).

Apply + 40 volts to terminal T of the regulator or manually close SR and C1.

THE ACCELERATOR PROGRESSES TO POSITION 135.

Make certain that the pilot motor is not receiving power in position 135 of the accelerator.

Remove the supply from terminal T and close B1.

THE ACCELERATOR REGRESSES TO POSITION 1

In progression and regression, check the time taken by the accelerator to travel the full distance(± seconds for 38 volt battery).

Lift wire D2 from the control box terminal block and interpose in the circuit a supply adjustable from 0-350 volts D.C. (positive polarity on D2 terminal; negative polarity to wire D2)

Gradually increase voltage and verify in succession:

- Closing of relay CCM
  Step by step progression of the accelerator

Gradually reduce the voltage and verify in succession:

- Step by step regression of the accelerator
  Opening of relay CCM

Remove the variable supply and reconnect wire D2.

ANTI-SLIP

Feed volts DC across terminals 10 (+) and 12 (-) of the anti-slip unit input panel and note:-

Immediate lighting of lamp DS2
Immediate closing of relay LOR
Immediate energising of the sanders (if FOR. or REV. contactors are energised)
Delayed energising of the track brake (if B2 is energised)

Remove the supply and note:-

Immediate extinction of lamp DS2
Immediate opening of LOR and the track brakes
Delayed de-energisation of the sanders.

Feed volts DC across terminals 10 (-) and 8 (+) of the input panel and note the same sequence.

Feed volts DC across terminals 4 (+) and 6 (-) of the input panel and note the same sequence except that DS2 is replaced by DS3.

Feed volts DC across terminals 4 (-) and 2 (+) of the input panel and note the same sequence as above.

ADJUSTMENT ON VEHICLE

Connect a voltmeter across the instruction measuring terminals of the control box situated at the forward driver's position.

Connect a 300 amp - 50V ammeter across the motor current measuring terminals situated in the cabinet at the rear driver's position.

Set the reverser to the forward position.

Depress the brake pedal to the maximum service position.

Adjust the maximum braking potentiometer (4) to obtain +7.6V at CS.

Release the brake pedal and adjust the minimum braking potentiometer (3) to obtain +2.75 volts at CS

Depress the traction pedal to the maximum position and adjust the maximum traction potentiometer (2) to obtain +10.6 volts at CS.

Depress the traction pedal to the minimum position (SR energised) and adjust the minimum traction potentiometer (1) to obtain +4.4 volts at CS.

After adjustment, verify that the voltages obtained at the rear driver's position are the same.

Drive the tram with the pedal in the minimum position and check from the ammeter that the regulated current is ±100amps.

Apply the brakes with the pedal at the minimum position and check that the regulated current is ± 65 amps.

Apply the brakes with the pedal at the maximum service position and check that the regulated current is ±175 amps.

Cut out two motors, drive with the pedal in maximum position, and check that the regulated current is ± 250 amps. (Cutting out two motors causes weaker acceleration, and maximum current holds long enough to allow a correct reading).

Return four motors to service and drive with pedal in the maximum position and check that the regulated current is ±250 amps.

At the control box, remove the coasting fuse and replace with a milliammeter. With the vehicle coasting, set the coasting potentiometer (5) so that the accelerator will regress when coasting current falls to 9mA.

Still coasting, disconnect the milliammeter and check that the equipment moves to braked coasting and that the regulated current is equal to the minimum braking current.

Date of test:

Vehicle number:

VOLTAGES : battery

\- + 40 V

- 40 V

- 24 V

+ 24 V

24 V 800 Hz

INSTRUCTIONS	No. 1 end	No. 2 end
Braking max.	V	V
min.	V	V
Traction max.	V	V
min.	V	V
Traction at series end	V	V

CURRENTS	No. 1 end	No. 2 end
Braking max.	A	A
min.	A	A
Traction max.	A	A
min.	A	A
Traction at series end	A	A

COASTING

Regression mA

POTENTIOMETER SETTINGS

R4/J4 R3/J7

R2/J4 R23/J7

CHOICE OF CURRENT INSTRUCTION VOLTAGE

Accelerator regulation card J1 is adjusted to control the pilot motor so that the negative measure voltage Ms- equals the positive instruction voltage Cs+. We can say, therefore, that the instruction voltage to be applied will equal the voltage produced as a measure of the motor current required.

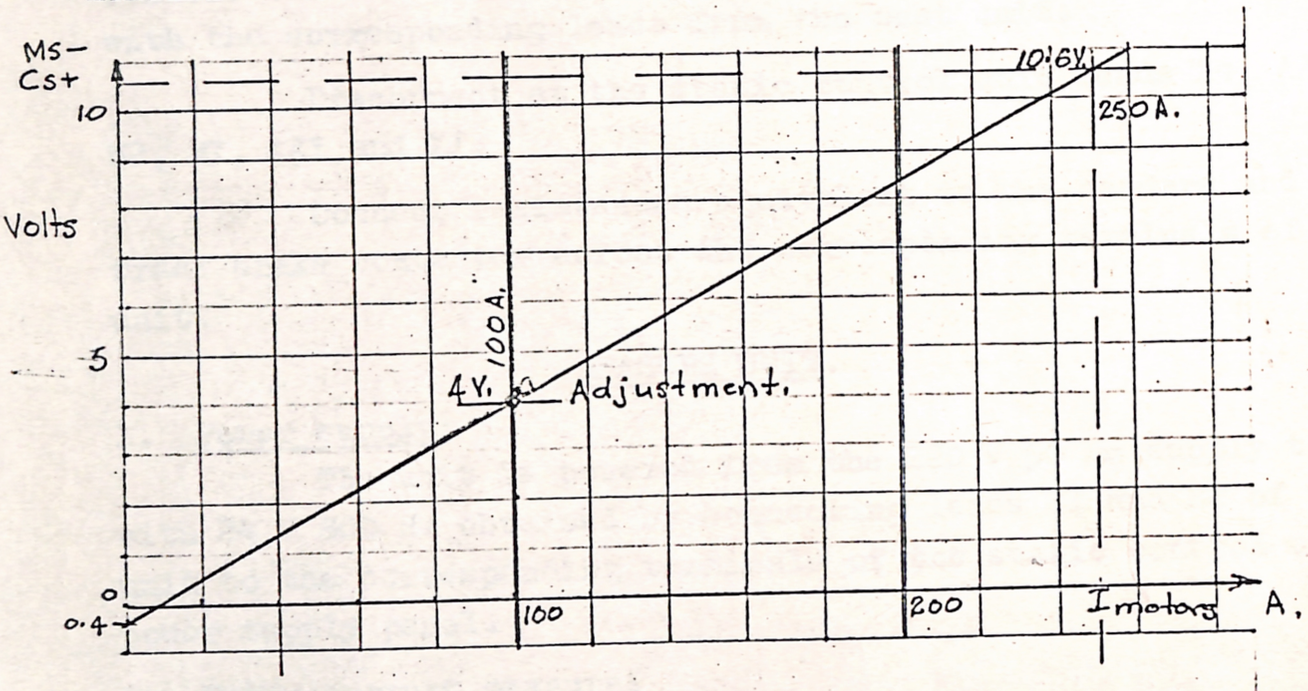
This measure voltage, in alternating form, is linear and proportional to the motor current, but the presence of a rectifier bridge introduces into the direct current a constant due to the threshold voltage of the diodes in the circuit.

If the value of this constant is about 0.4V and potentiometer IF of card J4 is adjusted to obtain 4V Ms- for 100 amps. motor current, it is possible to construct the following graph which represents, as a function of the required motor current, the value of the negative measure voltage Ms- obtained, that is, the value of the instruction voltage to be applied.

Example:
Assume a required motor current of 250A at maximum traction. Inspection of the graph shows that the corresponding Ms- equals 10.6V.

So that the instruction voltage Cs+ to be applied will have the same value, the maximum traction potentiometer of the control box will be set to obtain a voltage of 10.6 volts at Cs+ with the traction pedal depressed to maximum.

The value of different instructions may therefore easily be chosen as a function of required motor current first at minimum then at maximum current



TEST AND MEASURE UNITS.

INSTALLATION ON VEHICLE.

TEST UNIT.

1. Power Supply:

Connect cables +40 -40 and 8 B from the unit to the corresponding terminals of the static control unit.

2. When checking acceleration regulation:

Disconnect and isolate at the static control unit the vehicle cables marked T, F, V, 8M, LO, SD, CS+, K, L, M+, M- and replace them with the corresponding leads from the unit which are fitted with "Faston" lugs.

Connect cables K, L, M+, M- from the test unit which are fitted with male "Faston" terminals to the K, L, M+, M- cables from the vehicle.

Set the switch PM to "Vehicle".

3. When checking anti-slip:

Disconnect and isolate at the static control unit vehicle leads connected to terminals 19 and 20 and replace them with the corresponding leads from the test unit.

Disconnect at the static control unit leads X4, AA3, M2, MI, AAI and XI.

Connect resistances equivalent to the sanders and the track brake contactor across the corresponding terminals of the unit.

MEASURE UNIT.

1. Power supply:

The unit is powered from the 220 V 50 Hz supply together with 24 V 800 Hz obtained by connecting leads E1 and E2 of the unit to the corresponding terminals of the static control unit or power supply panel.

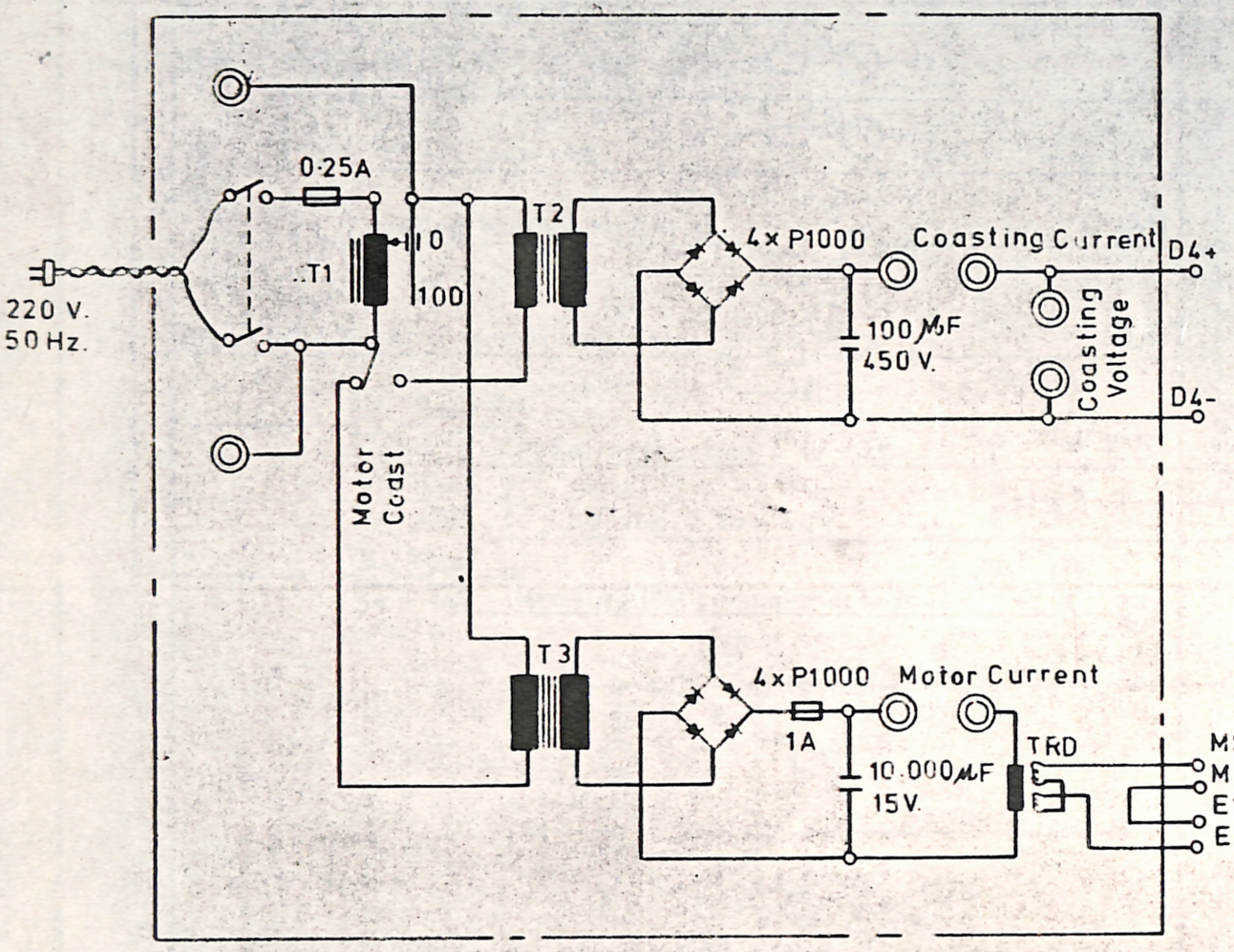
2. Motor current measure:

Disconnect and isolate at the static control unit vehicle leads MS1 and MS2 and replace them with the corresponding leads from the measure unit.

3. Coasting:

Disconnect at the control box terminal strip, lead D4 from the accelerator and replace it with lead D4+ from the unit. Connect D4- from the unit to lead D4 from the accelerator.

MEASURE UNIT FOR MIVG.



T1–Auto transformer adjustable 0-100 %

T2–Transformer, 220/440 V, 10 VA.

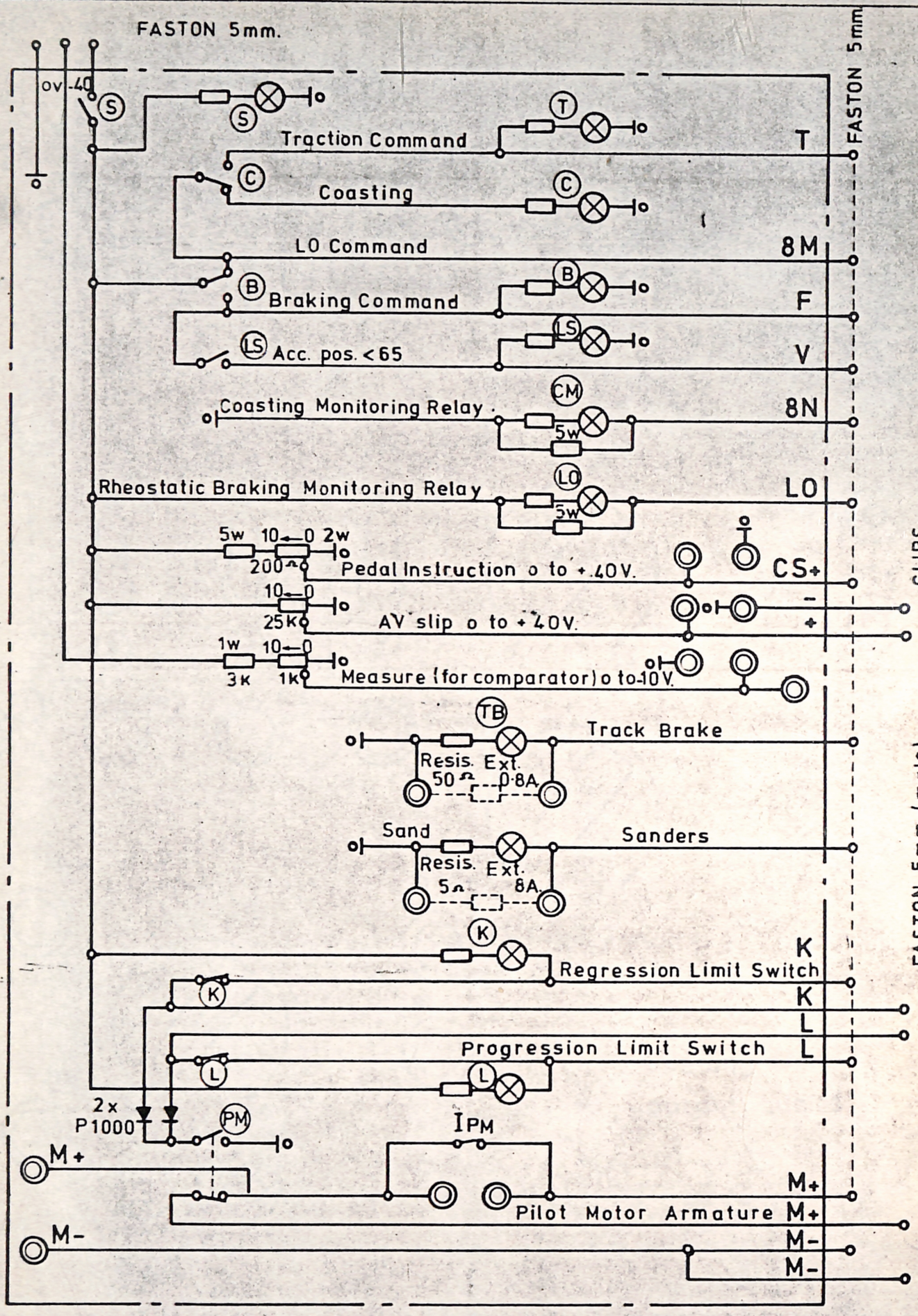
T3–Transformer, 220/ 6V, 10 VA.

TRD-Magnetic transductor, 500 turns/1200 turns

Output cables: Length, 2 metres.

SCHEMATIC DIAGRAM

TEST UNIT FOR MIVG.



Imput Leads: Length, 2 metres

The contacts shown are for switches in position "0" excep PM which is on "Vehicle"

SCHEMATIC DIAGRAM

TEST UNIT FOR MIVG.

