

Tactical

Distance Trip Meter (DTM)

London Underground Limited
Contract No. MCL0008

Instruction Manual

Contents

Introduction	2
Block diagram	2
Description	2
Distance measurement	3
Operator interface	3
Data retention	4
Power supply	4
Installation	4
System layout diagram	5
System connection diagram	6
System wiring list	6
Technical Specification	7
Ordering information	8
Supplier information	8

Copyright (C) 1998 Tactical Controls Limited

This document contains proprietary information which is protected by copyright. All rights reserved. This document or parts thereof may not be reproduced in any form without written permission of the publishers.

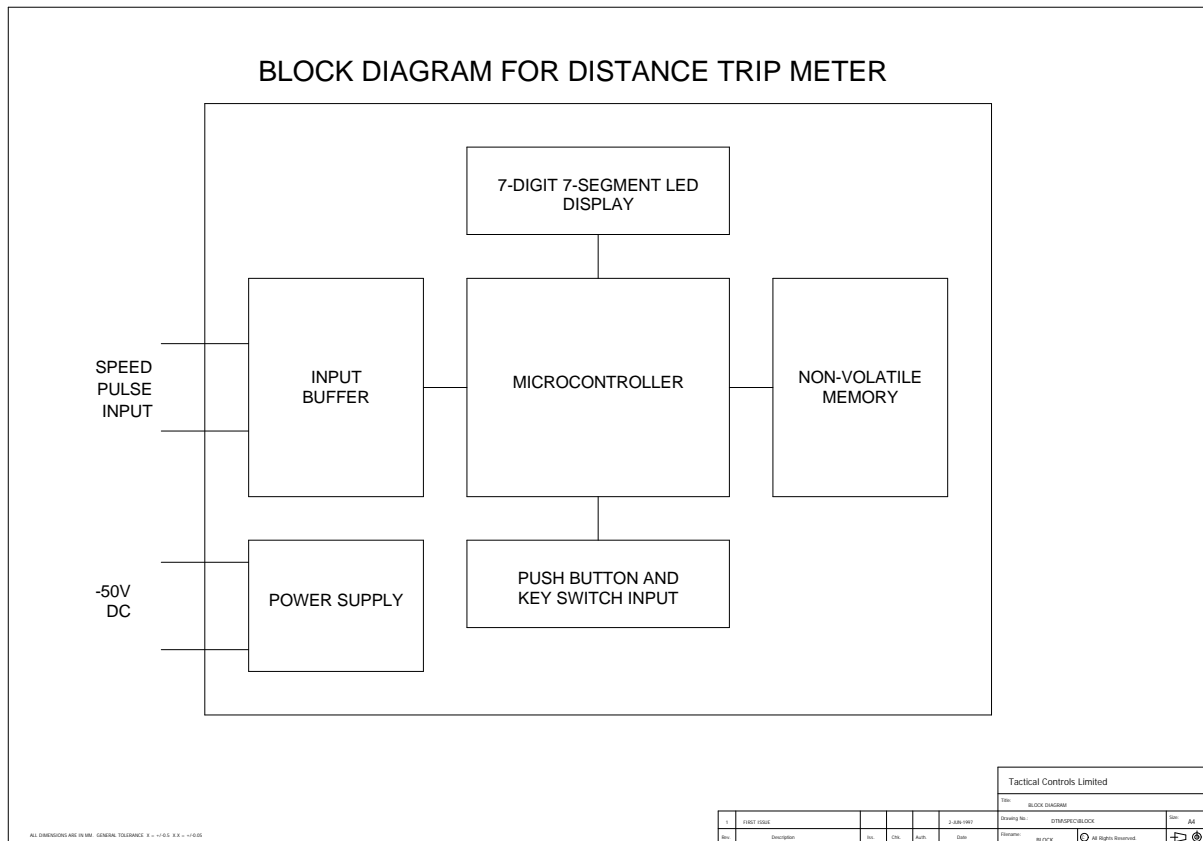
The information in this document is subject to change without notice and should not be construed as a commitment by Tactical Controls Limited. Tactical Controls Limited shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance or use of this material.

Introduction

This instruction manual describes a microprocessor-based **Distance Trip Meter (DTM)** with application to London Underground Limited; C Stock, Hammersmith and Circle Line, LUL contract No: MCL0008.

The DTM is designed to interface with the Electronic Speedometer (ESU) and stores the distance travelled, up to three distances are to be stored.

Block diagram



Description

At the heart of the system is the microprocessor which reads the Distance Pulse input signal from the Electronic Speed Unit (ESU), this signal is transient protected, buffered hardware and software filtered before it is connected to the microprocessor input.

The single row of 7-digits 7-segment Light Emitting Diode (LED) display is controlled by the microprocessor using dedicated display integrated circuits.

The supply to the microprocessor is derived from the -50Vdc supply via a step-down switch mode power supply. It is surge and transient protected.

The DTM is supplied with Litton 5-way, shell size 16S, bayonet connector; the receptacle is fitted with pins. The free plug is fitted with 2 meters of 3 core screened cable, terminated with four M5 rings and cable markers.

Please see Layout diagram for detail.

Distance measurement

The microprocessor works out the Distance by means of continuously measuring the timing between each cycle of the Distance signals, from which it could calculate the distance travelled.

Unfiltered square pulse signals from the Electronic Speed Unit (ESU) are fed to the input of the DTM, these pulses undergo hardware and software filters inside the DTM and the clean signals are then fed to the microprocessor input.

The Distance Pulse Signal

The distance pulse signal is generated by the ESU which has a buffered output.

The signal amplitude from the ESU is -15Vdc and floating with respect to ground (0V); The output is floating when there is no signal.

For detail, please see Interface Board drawing, drawing number 91701.

The DTM can also be connected directly to an unbuffered ESU signal.

The frequency/speed ratio is 17.74Hz/MPH.

It must be borne in mind that the Distance Pulse signal connections between the ESU and the DTM unit are not isolated; both units voltages referred to the system Ground (0V).

It is also important to note the Distance Pulse output signal from the ESU must be within +/- 1.0Vdc of the specified amplitudes - otherwise the DTM might not response to it.

The maximum train's speed is set at 70MPH.

Operator interface

The operator interface consists of:

1. A single row of 7-digit 7-segment LED display.
2. Three push-buttons.
3. A key-switch.

The display

The 7-digits 7-segment LED display is used to display three distance parameters, these are: A, B and C. These distance parameters are displayed in KM with leading zeros. The display is normally OFF and would display a value when any of the three push-buttons is depressed.

Display test

When any one of the three push buttons is pressed, the display will show all "8" for 2 seconds before reverting to its normal display.

Key-switch

A single key-type is used for all cars to reset the distance parameters. The key is spring biased in the insert position. In the event that the key has been accidentally left in the insert-position while the car is in operation, the unit continues to operate normally.

Speed test

To display the current speed in mph, press any two of the three push buttons simultaneously. The display will show "bbbSPss" where "SP" represents speed, "b" is a blank digit and "ss" is the speed ranges from 0 to 70 mph.

Reset procedure

To reset a distance parameter to zero, for example, the A distance parameter:

1. Press and hold the A button.
2. Switch and hold the reset-key to Reset position (non-removable).
3. Observes that the display would count down from 10.
4. When count down reaches zero, release and remove key.
5. Observes that the display reset to zero.

Data retention

The DTM is designed to ensure that the data retention capability of the unit has good RFI immunity. The use of a single-chip microcontroller with special built-in EEPROM offer high reliability for parameter storage. Also the unit's metal enclosure is designed to provide good RFI shield.

Power supply

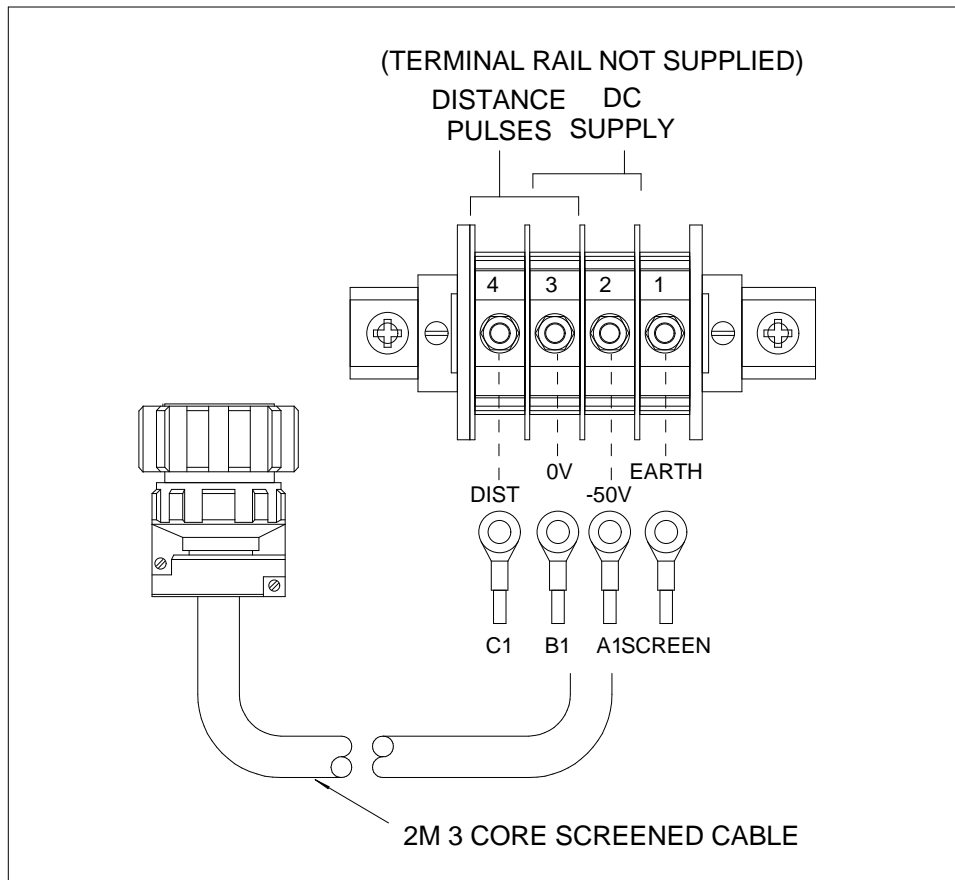
The DTM is powered by the Train's control supply which is nominally -50Vdc with the positive pole earthed. The design can accommodate a ripple of up to 5V peak to peak, at a nominal frequency of 850Hz and associated harmonics. DTM's supply input is designed to withstand the RIA12 Surge and Transient tests.

Installation

The DTM is supplied with one angle bracket for fixing. Please see System layout diagram for details.

A screened 3-core cable of 2M length, terminated with M5 rings and cable marker, provides all the external connections. Please see System connection diagram and System wiring list for details.

System connection diagram



System wiring list

Cable Marker	Description
A1	-52V supply
B1	0V earth
C1	Distance pulse signal
Screen	Earth

Technical Specification

Supply

Voltage	-32 to -63 Vdc; -50 Vdc nominal.
Ripple	Unaffected by 5 volt peak to peak.
Input protection	Reverse polarity protection. Surges and transients to BRB/RIA 12.
Current consumption	100mAdc maximum at -50Vdc (when display on) 20mAdc at -50Vdc (when display off)

Sensor

Pulse input	Signal amplitude is between -8.5V & -12.5V peak to peak with respect to earth with frequency/speed ratio of 17.74Hz/MPH.
-------------	--

Indicators

7-digit display	Green 7-segment LED display, 7.6mm height. Distance in KM; speed in MPH.
-----------------	---

Operator interface

Key switch	100mA, 25Vdc rating minimum; electrical life over 10,000 operations; 1 pole, contacts normally open; key in non-removable position with switch contacts closed; spring biased in insert position; panel mounted; IP65 rating.
Push buttons	100mA, 25Vdc rating minimum; electrical life over 10,000 operations; contacts normally open; IP65 rating.

Electrical interface

Connector	Litton bayonet connector, 3-way, shell size 16S; complete with 2 meters of 3 core screened cable; cable terminates with M5 ring.
-----------	--

Environment

Operating temperature	-15°C to +55°C.
Storage temperature	-30° to +85°C.
Relative humidity	0 to 90%.
IP rating	IP65

Mechanical

Dimensions	To LUL sketch TPIE/SRD/ODO/03; see layout diagram for detail.
Housing	Material: aluminium, zinc plated, natural.

Standards

RSE/STD/031/PART 1: ISSUE B	General requirements for electronic equipment
BRB/LUL/RIA No.13: 1990	General specification for electronic equipment
BRB/LUL/RIA NO.12:1984	Surge and Transients testings
BRB/LUL/RIA NO.18:1990	Interference testings
BRB/LUL/RIA NO.20:1988	Vibration and shock testings.

Warranty	12 months return to base.
-----------------	---------------------------

Ordering information

Ordering code: DTM

You are welcome to order the unit by code or by description - DTM Distance Trip Meter.

Supplier information

Tactical Controls Limited

Unit 4 Marlborough Road
Lancing, West Sussex BN15 8TR
England
Tel: (01903) 750800
Fax: (01903) 750678