

COMMANDABLE BEACON

M7710

OPERATOR HANDBOOK

(c) Micromill Electronics Limited

Micromill Electronics Limited owns the copyright of this document which is supplied in confidence and must not be used for any purpose other than that for which it is supplied and must not be reproduced without permission in writing from the owners.

The product described in this manual is subject to continuous development and improvement. All particulars of the product and its use (including the information and particulars in this manual) are given by Micromill Electronics in good faith. However, it is acknowledged that there may be errors or omissions in this manual.



CONTENTS

SECTION	PAGE
Preliminaries	
Title Page	1
Contents	2
Chapter	
1 INTRODUCTION	3
1.1 General	3
1.2 Notes and Cautions	3
1.3 Accessories and Related Equipment	4
1.4 System Block Diagram	5
2 INSTALLATION	6
3 OPERATION	7
3.1 General	7
3.2 Stand Alone Mode	7
3.3 Slave Mode	8
3.4 External Trigger	8
3.5 Pseudo Non pulsing Mode	9
3.6 Low Interference Signature	9
3.7 Beacon Power	9
3.8 DIL Switch Functions	9
4 FAULT FINDING	10
5 SPECIFICATION	10

1 INTRODUCTION

1.1 GENERAL

The M7710 is a 1 Watt Commandable Beacon, which is used with the M7119 Command and Display Unit and the M7131 DF Receiver, to form a versatile Mobile Tracking System. When the Beacon is fitted with a M7914 Antenna and M7927 Battery Pack, it forms a small water tight, self contained unit, which can be quickly and easily deployed. Alternatively, the Beacon may be powered from an external source via the M7931 DC I/P cable.

Transmissions are modulated with an identification pulse and a movement signal which can be monitored on the audio output of the Tracking Receiver. Transmissions include digitally encoded data which can be used at the Tracking Receiver to indicate the operating mode, movement status and battery state of the Beacon. This is particularly useful to show whether the Beacon is moving or stationary during pulsed transmissions which would not otherwise convey this information. The digital data is decoded and displayed on the Status Display of the M7119.

The M7710 is fitted with an auxiliary connector, which supports an external trigger input and relay control output. The external trigger can be used to activate the beacon when an external event occurs, such as a micro switch closing. The relay control output can be used to operate an external power relay by remote command, this power relay may then be used for a variety of tasks such as stopping the engine of the target vehicle.

1.2 Warnings and Cautions

WARNING

Reverse Charging Lithium Batteries

Do not reverse charge lithium batteries. Explosions and risk from fire may result. Care should be taken not to connect the M7927 Battery Pack to an external supply, eg using the M7931 DC I/P cable.

Short Circuiting Lithium Batteries

Do not short circuit lithium batteries. Explosions and risk from fire may result. Care should be taken when connecting the M7927 Battery Pack to the M7710 Beacon using the M7929 DC Link Cable. Connect the M7929 DC Link Cable to the M7710 Beacon first, then to the M7927 Battery Pack.

Note: The preferred batteries 'Saft LSH14' are fitted with internal fuses. This will prevent damage due to short circuit. However, if the battery pack is short circuited during connection, the internal fuse will blow and the batteries will immediately appear dead.

CAUTIONS

When using an external power source, the maximum supply voltage must not be exceeded as this may cause permanent damage to the unit.

The maximum pull down parameters of the relay drive must not be exceeded as this may result in permanent damage to the relay driver.

It is recommended that fresh batteries be used at the start of an operation if the state of the existing batteries is unknown.

When used with the M7927 Battery Pack, the M7929 DC Link Cable powers up the Beacon, and so should not be fitted until just prior to deployment, to save battery power.

1.3 Accessories and Related Equipment

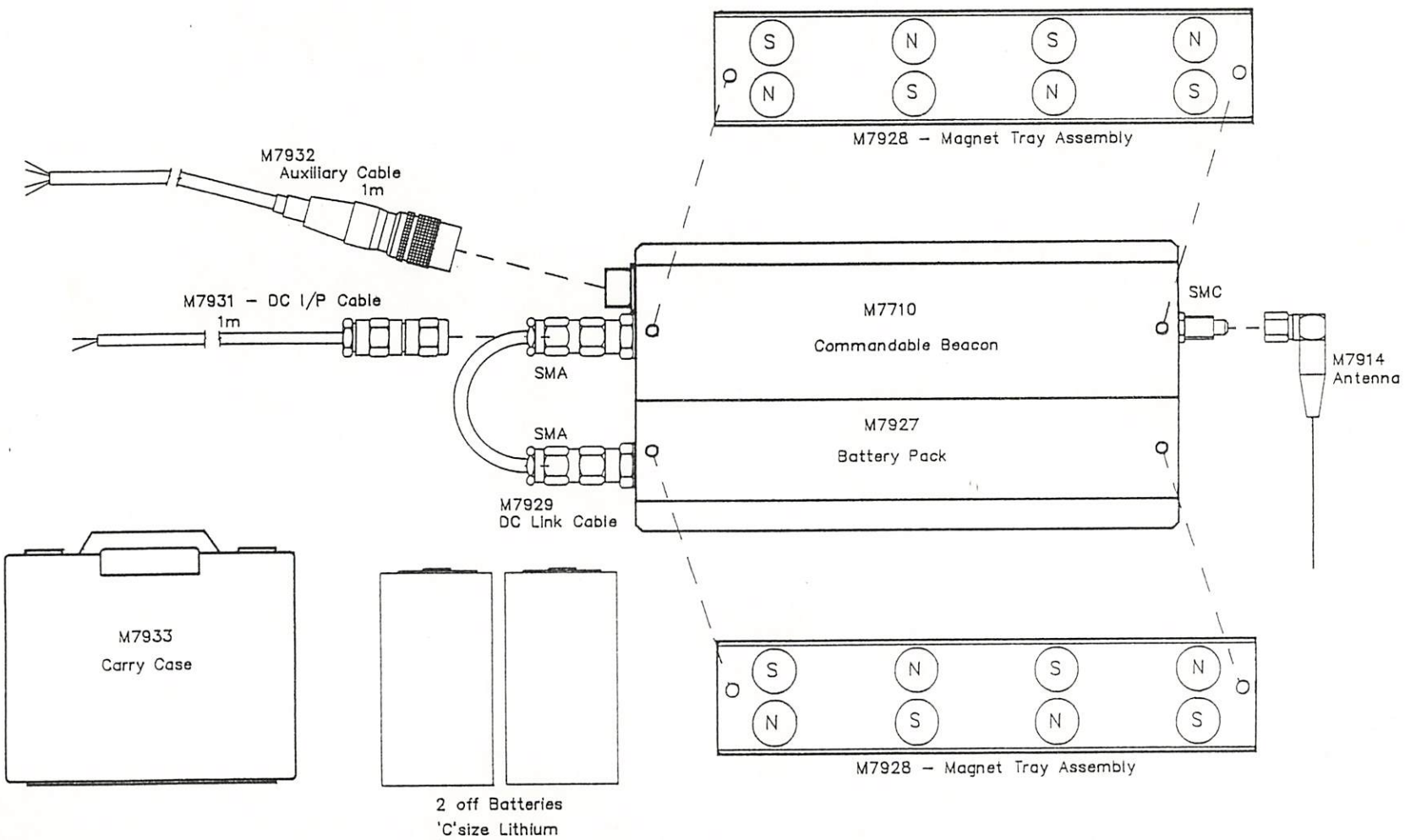
Accessories

M7927	Battery Pack
M7929	DC Link Cable
M7914	Antenna
M7932	Auxiliary Cable
M7931	DC I/P Cable
M7928	Magnetic base
M7933	Carry Case

Related Equipment

M7131	Mobile Tracking Receiver
M7119	Command and Display Unit
M7611	Beacon Command Unit (essential for Beacon Slave Mode)

1.4 System Block Diagram



2 INSTALLATION

The procedure outlined below refers to installation of the Beacon on a vehicle or similar large metal structure.

Installation with M7927 Battery Pack

- 1 Remove the Beacon power, by disconnecting the cable from Beacon SMA socket.
- 2 Remove the lid from the M7927 Battery Pack. Fit two new Saft 'C' size LSH14 or equivalent batteries. Replace the lid.
- 3 Remove the M7710 Beacon lid and set the DIL switches SW1 and SW2 to give the required options. See section 3.8 for the details. Replace the lid.
- 4 The M7710 Beacon and M7927 Battery Pack may be fitted together mechanically using the captive screw in the Battery Pack. This is optional, it may be more convenient to deploy the beacon and Battery Pack separately, connected only via the DC link.
- 5 The M7710 Beacon and M7927 Battery Pack may be fitted with a magnetic bracket, for quick deployment on ferrous metal objects. If required a M7928 magnetic bracket should be fitted to both the Beacon and Power Pack using two M3x5 pan head screws.
- 6 Fit the M7914 Antenna to the SMC socket on the Beacon and secure. Ensure Antenna and Beacon frequency codes match.
- 7 First connect the M7929 DC Link Cable the SMA connector on the Beacon then the SMA connector on the Battery Pack. This should be fitted just prior to deployment to conserve battery power.
- 8 The Beacon may now be deployed, using the Magnetic fixing or otherwise.

Installation using external supply

The Beacon may be deployed without the Battery Pack, if an external supply is available. The external supply should be 6 to 16 volts DC and be capable of supplying 0.4 amps.

To deploy the Beacon with an external supply follow the previous procedure , but omit steps 2 and 4, and replace step 7 with:-

- 7 Connect the M7931 DC I/P cable to the SMA socket on the Beacon. Connect the inner of the free end to the positive of the external supply and the outer to the negative of the external supply.

Auxiliary Functions

The auxiliary connector on the Beacon supports a relay driver output and an external trigger input. If either of these functions are required, the M7932 Auxiliary Cable should be fitted to the Beacon.

The connections to the auxiliary connector are as follows:-

Pin 1	Green	0 V
Pin 2	Red	Trigger
Pin 3	Yellow	- (make no connection)
Pin 4	Blue	Relay

3 OPERATION

3.1 General

When power is first applied, the unit is initialised into a 10 second wait state in which the transmitter is off, then movement trigger is enabled and the relay drive is set to high impedance. The pulsing or non-pulsing mode is selected upon power up dependent on the position of the DIL switch SW1-8 inside the M7710 unit. If DIL switch SW1-8 is off, then non-pulsing mode (or 1 Watt continuous) is selected. If the DIL switch is on, then pulsing is selected (or 1 Watt pulsed). Although the transmitter is initially off, it will probably be energised during the deployment as the movement trigger is enabled.

Non-pulsing transmissions are modulated with an identification pulse and a movement signal which can be monitored on the audio output of the Tracking Receiver. Both pulsing and non-pulsing transmissions include digitally encoded data which can be used at the Tracking Receiver to indicate the operating mode, movement status and battery state of the Beacon.

3.2 Stand Alone Mode

When initially powered-up, the unit is automatically set into the movement trigger mode permitting it to be operated as an independent movement-triggerable beacon, without the need of a Command Unit. The transmitting mode (pulsing or non-pulsing) is operator selectable by DIL switch SW1-8 inside the unit.

While untriggered in the movement trigger mode, the unit generates a 'confidence' transmission of approximately 2 seconds every minute for the first 6 hours, then 1/10 second every minute thereafter. Upon being moved, the transmitter adopts the appropriate pulsing or non-pulsing mode and will turn off after approximately 15 minutes if not re-triggered. In the pulsing mode the transmitter is energised for approximately 1/10 second every 0.8 seconds whereas in the non-pulsing mode the transmitter is energised continuously except for 1/8 second every 1.6 seconds (to permit reception of commands).

3.3 Slave Mode

The Beacon contains a control receiver which allows the unit to receive and respond to signals from the Command Unit.

When used as a Slave, the following modes are controlled by the Remote Control Command Unit:-

- a) Transmitter on/off
- b) Pulsing/non-pulsing transmitter operation
- c) Movement trigger on/off
- d) Independent relay drive, pull low or high impedance

The Remote Control System is based on a well proven, very high reliability technique which virtually eliminates the possibility of the Beacon being incorrectly controlled by radio interference or spurious signals.

A short press of the command button initiates a 1/2 second Command transmission which is normally sufficient to provide immediate control. However, when the Beacon is transmitting in the non-pulsing mode or is in the inactive mode, command signal periods of up to 5 seconds should be sent by holding down the appropriate command button for that period. Command signal periods greater than 1/2 second may also be required when operating the system at long range or in poor signal areas.

The unit can be controlled by the Command and Display Unit M7119 in the following ways:-

Transmitter

There are no transmissions while the transmitter is 'off' and the movement trigger is disabled. When commanded to turn on, the transmitter is energised in the previously selected pulsing or non-pulsing mode.

Pulsing

The pulsing option can be selected whether or not the transmitter is enabled. It does not turn on the transmitter but determines the mode of transmission when it is enabled by other means.

Movement Trigger

The movement trigger can be enabled at any time. If the transmitter is on due to movement triggering, the 'Movement Trigger Off' command will cancel the movement trigger mode but not turn off the transmitter, whereas the 'Target Transmitter Off' command will turn off the transmitter but leave movement trigger enabled.

Relay Drive

The relay drive auxiliary output can be pulled low following a RELAY ON command, or allowed to float high following a RELAY OFF command. The relay operation is independent of other Beacon functions.

3.4 External Trigger

The external trigger input is permanently enabled. If the Trigger input on the Auxiliary Cable is pulled low at any time the Beacon will transmit in non-pulsing or pulsing mode dependent on the position of DIL switch SW1-8.

3.5 Pseudo Non-pulsing Mode

The Beacon Non-pulsing mode may be replaced by a 'Pseudo Non-pulsing' mode, by switching DIL SW1-7 on. In Pseudo Non-pulsing mode the beacon transmits 20mW continuously, but pulses the full 1 Watt once every 0.8 seconds. At close range the Beacon appears to be in Non-pulsing mode, but as the range increases will appear to be in pulsing mode. This mode is useful for extending the endurance of the power source by approximately 5 times.

3.6 Low Interference Signature

Many applications require the Beacon not to interfere with other electronic equipment. The Beacon has been designed to minimise the generation of harmonics and spurious signals and to remain stable when mismatched.

If there is a requirement to disable the data transmissions, in order to further reduce interference the DIL switch SW2-2 may be set on. This will allow movement modulation to be transmitted but not data.

3.7 Beacon Power

The beacon can be powered from the M7927 Battery Pack or from an external power supply. The M7927 battery pack contains two 'C' size Lithium thionyl chloride cells and may be attached to the beacon to form a self-contained unit. Where size and/or shape is critical the units may be mounted independently, connected by a DC link only. If available an external power source may be used in place of the battery pack. Cable M7931 is available for this purpose.

3.8 DIL Switch Functions

The beacon is fitted with two DIL switches SW1 and SW2, which may be accessed by removing the Beacon lid. A summary of the DIL switch functions is given inside the Beacon lid.

- | | | |
|-----|--------|--|
| SW1 | 1 to 6 | Beacon identity 0 to 63. The identity is binary encoded, with 1 being the lsb and 6 being the msb. On is binary '1' and off is binary '0'. |
| SW1 | 7 | Pseudo Non-pulsing mode select. Normally set off, to provide 1 Watt continuous when the Beacon is in non-pulsing mode. Set on to provide 20mW continuous 1 Watt pulsed every 1.6 seconds when the Beacon is in non-pulsing mode. |
| SW1 | 8 | Power up mode select, particularly important in stand alone mode. If set off then following power up the Beacon will be in movement trigger mode and will transmit in non-pulsing mode upon movement. If set on then following power up the Beacon will be in movement trigger mode and will transmit in pulsing mode upon movement. |
| SW2 | 1 | Not used in normal operation and should be set in the off position. |
| SW2 | 2 | Disable data modulation. In applications where data transmissions interferes with other electronic equipment. Normally, set on to enable data modulation, set off to disable data modulation. |

4 **FAULT FINDING**

To be defined.

5 **SPECIFICATION**

Transmitter	Power	1 watt into 50 ohms
	Frequency	Crystal controlled in range 27 to 175 MHz
	Harmonics	Below -30 dBm
	Modulation	1 kBaud FSK provides: Identity (0 to 63) Beacon status
	Interference	The transmitter design is optimised to prevent interference with other electronic equipment. The transmitter oscillator is stabilised prior to transmitting and power is ramped rather than switched, greatly reducing spurious signal generation.
	Stability	No spurious signals above -30dBm are generated when the VSWR of the load is below 3:1.
Receiver	Sensitivity	Greater than -112 dBm from 50 ohms
	Frequency	Crystal controlled in range 27 to 175 MHz (within 5% of transmitter frequency)
Antenna	Type	External 50 ohms (eg M7914 matched whip)
Command Modes	Tx on/off	Transmitter on until commanded off, or off awaiting further commands or triggers (if triggers enabled).
	Pulsing on/off	Transmitter pulses on for 1/10 sec every 0.8 sec or on continuously (short breaks every 1.6 sec).
	Movement Trigger	Transmitter triggered on by movement and continues for approx 15 minutes after movement stops. It then adopts a state in which the transmitter emits a "confidence" pulses every minute. The confidence pulse has a 2 second duration for the first 6 hours and 1/4 second thereafter.
	Relay on/off	Provides output via the Auxiliary connector to operate an external power relay. Relay drive, 0.5 A pull down to earth.
External Trigger		Connecting the trigger input (via Auxiliary connector) to OV triggers transmitter on.
Inactive Mode		The unit adopts a special power saving mode during periods of inactivity, this doubles its endurance. It adopts this mode when the transmitter has been commanded off and no trigger or command has been received for 15 minutes.

Stand-Alone Mode

From power-up and in the absence of any commands, the beacon automatically adopts the movement trigger mode as described above.

Mechanical

M7710 Beacon

Size - 123 x 31 x 34 mm
Weight - 160 g approx

M7927 Battery pack

Size - 123 x 31 x 31 mm
Weight - 205 g, including batteries

Power Source

Integral

M7927 Battery Pack (6 volt)
Two 'C' size lithium cells eg Saft LSH14
Via M7932 auxiliary cable
6 to 16 volts DC at 0.5 amp peak

External

Endurance

Mode

With M2927 battery pack at 20°C:
Tx off 72 days nominal
(140 days if inactive)
Confidence 70 days
Pulse 4.5 days
Non-pulsing 14 hours
Pseudo N-p 3 days

Environmental

Temperature

Operating -10°C to +50°C
Storage -20°C to +70°C

Sealing

IP65