TRANSPARENT TECHNOLOGIES

M2 Utility Radio
Operations Manual

Transparent Technologies, Inc
5665 Airport Blvd
Boulder, CO 80301
720-406-1294

Version
M2 Version 01.14

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M2

Utility
Radio
Transceiver

Operations
Manual

OVERVIEW

M2
*Utility
Radio
Transmitter*

Univeral
The M1 radio is a universal AMR device designed for every utility. Encoder and digital inputs for all major water meter registers.

Simple
The M1 operates in an unlicensed mode in the 900-Mhz range which requires no utility regulation. The radio is easily configured and interfaced with an off-the-shelf PDA.

Powerful
In addition to reliable meter reading, the M1 also provides powerful datalogging, consumption profiling and leak detection. The M1 transmit basic meter and leak detection information through the RF signal.

Basic Specifications

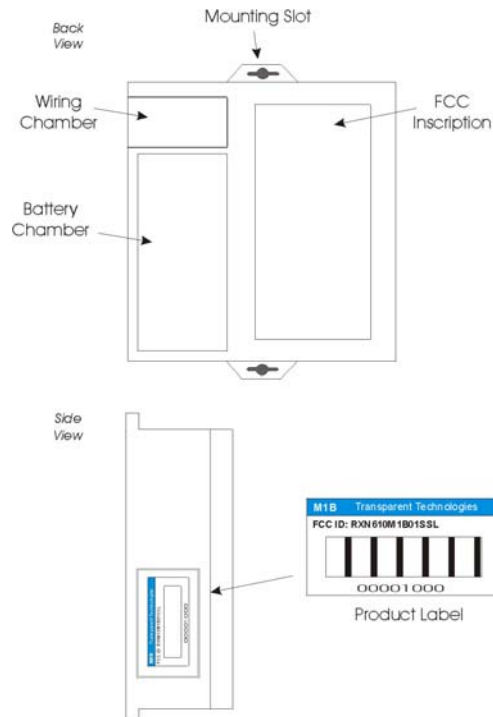|	
Transmission:	One-Way DTS Two-Way DTS (unregulated)
Regulatory:	FCC 15.247
Temperature:	-40°F to 158°F (-40°C to +70°C)
Humidity:	100%
Submersion:	IP-68 Rating Fully submersible
Packaging:	PCB 100% encapsulated
Housing:	Smoke or Clear Polycarbonate
Interface:	All Major Encoders All Major SC/Pulse See Chart
Battery:	Replaceable 19.0 A-hr D-cell
Battery Life:	Up to 20 years

M2 Packaging

The M2 is housed in a polycarbonate shell with multiple levels of waterproofing. The housing is available in either a clear or smoke tint.

The housing is assembled with a UV-cure adhesive which provides the first level of environmental protection. The radio electronics are 100% encapsulated in a dielectric gel for 100% moisture protection. Finally, all cable entry/exit points are sealed with gel grommets to protect against long-term moisture penetration.

The rear of the radio unit provides the access chambers for the wiring connections and the replaceable battery.

The product label indicates a model number, a lot/serial number and the FCC identifier.

Back View

Mounting Slot

Wiring Chamber

FCC Inscription

Battery Chamber

Side View

M1B   Transparent Technologies
FCC ID: RXN 610M 1B01SSL

00001000

Product Label

INSTALLATION & WIRING

Installation

The M2 is designed for all environments and can be installed either in indoor or outdoor environments.

Mounting Orientation

The most important consideration is to keep the M2 radio unit **UPRIGHT** when it is installed.

The antenna is located on the top of the radio board and the RF transmission pattern is optimized with an upright orientation.

In the UPRIGHT position:
- The hanging slot is at the top of the unit
- The T2 logo will be readable at the top of the housing
- The battery will be at the bottom

Other primary considerations for optimum transmission:
- Avoid mounting the radio unit directly against metal surfaces (pipes, valves, etc.)
- Avoid mounting the unit below typical water levels.
- Do NOT drive screws or mounting hardware into the unit's plastic housing.
- Always mount the unit at the highest grade possible.

Location of Antenna

Mounting Orientation

In all cases, the installer should experiment with mounting techniques and RF performance prior to quantity installation.

Pit & Vault Installations

For best transmission, the unit should not be mounted directly on any metal surfaces, such as pipes or valves, or mounted below know water levels.
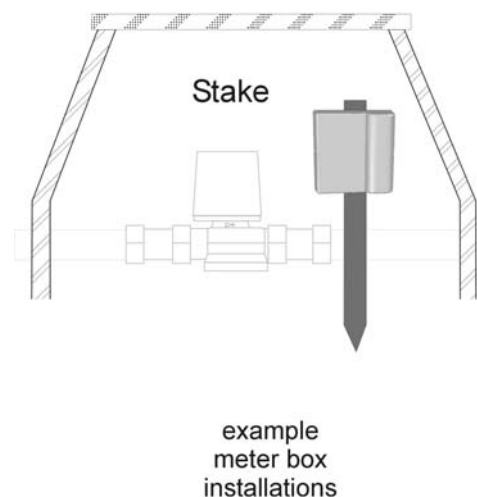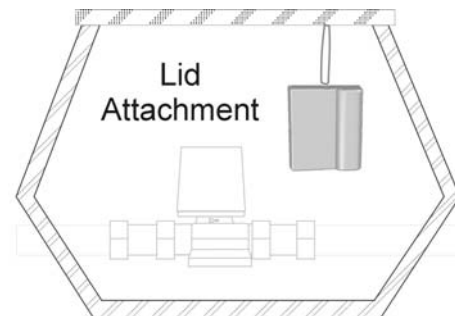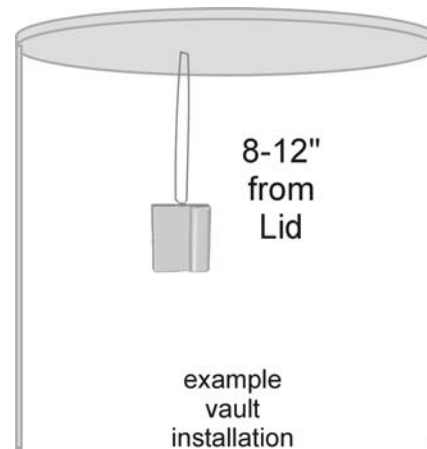
The M1B has multiple mounting options, including a slot for wire ties which can be used to hang the M1A, attach on a plastic stake or screw directly onto a wall.

An effective mounting technique for commercial meter vaults is to hang the M1A unit from a fixture (such as a ladder rung or the lid itself) near the top of the vault. Proper mounting in these types of vaults is essential for good RF performance.

For smaller vaults and meter boxes, a variety of acceptable mounting options are available. Two simple methods are hanging from the lid/cover and staking into the ground.

If time and space are available, the M1A can also be mounted on the side of a pit with a wall bracket.

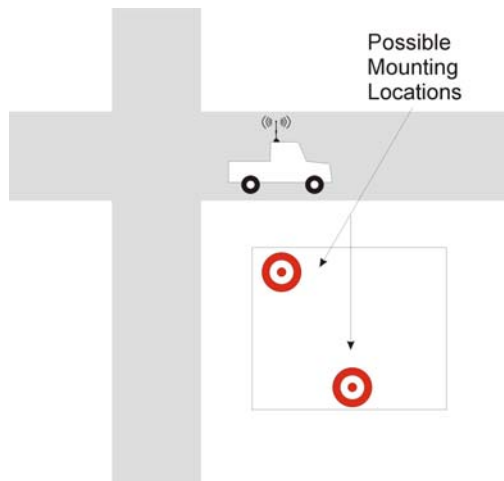**For vaults or pits with metals lids, the M2 should be optimally mounted 6-18 inches below the lid/cover.**

8-12" from Lid

example vault installation

Lid Attachment

Stake

example meter box installations

Indoor & Wall Installations

For best transmission, the unit should not be mounted backing on metal surfaces, reinforced concrete or other dense surfaces.

In indoor mounting situations, a higher mounting site will improve RF performance.

In below grade sites (e.g. basements), the installer should experiment with the best location before the final mounting. In these instances, the direction/bearing of the receiver should be considered.

For instance, if a unit is to be mounted in a basement with reinforced concrete walls, the best mounting location could be on the opposite wall, although this increases the overall distance.

Possible Mounting Locations

Wiring

Encoders

As a default communication The M2 utilizes the ECR-II communications defacto-standard wiring conventions for encoder interfaces:
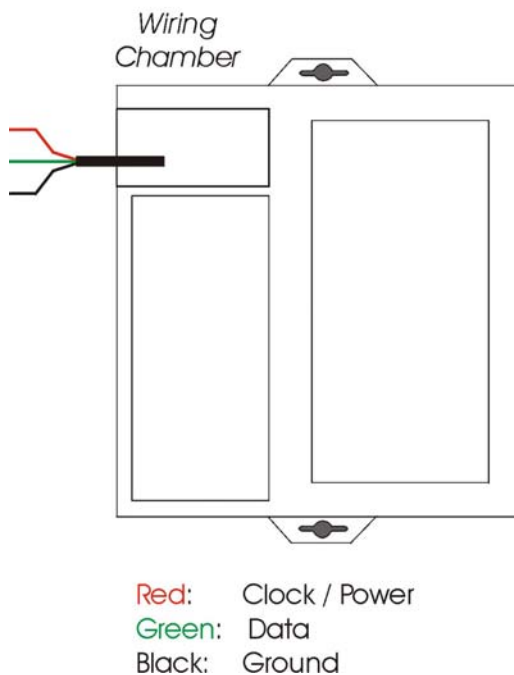
Red: **Clock/PWR**
Green: **Data**
Black: **Ground**

This wiring convention should be consistent with all Metron-Farnier, ECR-II and ECR-III registers.

The unit can be ordered with a pre-wired cable in 5-ft increments. In this case, the cable with leads will exit on the side or bottom of the unit.

For field retrofit applications, the unit can be ordering with leads ready for splicing in the wiring chamber.

Wire Connections

The wiring connections are critical for reliable radio-to-register communications.

T2 recommends the use of 3m gel-cap type terminations. These connectors and the crimping tools are available at many hardware stores and online distributors.

Follow directions included with the gel-cap packaging to ensure proper terminations.

Encoded Registers

Wiring Chamber

Red: Clock / Power
Green: Data
Black: Ground

Pulse Wiring

For standard pulse wiring, the red and black wires should be connected to the pulse output of the register.

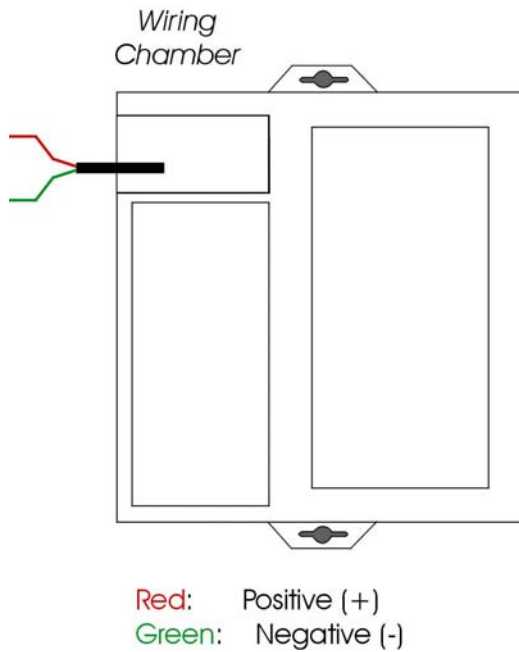Check the T2 wiring guide for color coding for most registers.

Wire Connections

The wiring connections are critical for reliable radio-to-register communications.

T2 recommends the use of 3m gel-cap type terminations. These connectors and the crimping tools are available at many hardware stores and online distributors.

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Pulse Register

Wiring Chamber

Red: Positive (+)
Green: Negative (-)

Dual Enconder / Pulse

Metron-Farnier offers a unique register that supplies a encoder-output for meter reading purposes and a pulse output for datalogging purposes.
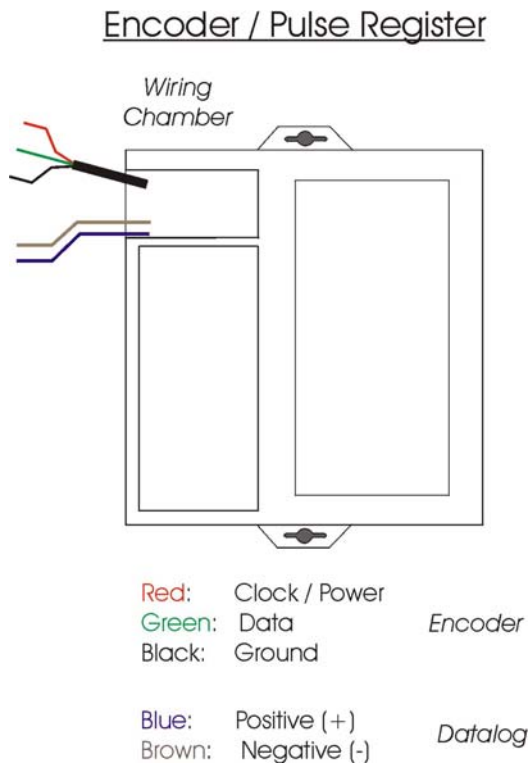
This special-order unit will have multiple wiring connections: one for the encoder output and one for the switch closure output.

Wire Connections

The wiring connections are critical for reliable radio-to-register communications.

T2 recommends the use of 3m gel-cap type terminations. These connectors and the crimping tools are available at many hardware stores and online distributors.

Follow directions included with the gel-cap packaging to ensure proper terminations.

Encoder / Pulse Register

Wiring Chamber

Red:	Clock / Power	
Green:	Data	*Encoder*
Black:	Ground	

Blue:	Positive (+)	
Brown:	Negative (-)	*Datalog*

OPERATION

Operation

The M2 radio operation is covered in five topics:

- ON/OFF Control
- Configuration
- Meter Reading
- Datalogging
- RF Operations

Refer to the FPDA, H2 and G2 Manuals for additional instructions on the operation of the M2 radio.

This manual only provides an overview on these topics.

ON/OFF Control

If the M2 radio has been purchased as a separate unit, it will be shipped in the default setting. This will be in the OFF mode.

The Field PDA, H2 handheld or G2 provides the ability to set the M2 into one of three modes:

OFF: The RF transmission, meter interface and all data functions are off. The unit will monitor the IrDA port for ON/OFF commands.

Standby: The RF transmission function is off but the meter interface and all data functions are on. The unit will monitor the IrDA port for ON/OFF commands.

ON: The RF transmission, meter interface and all data functions are on. The unit will monitor the IrDA port for ON/OFF commands.

Configuration

The M2 radio is a flexible unit with configuration options available for tailoring the unit for a specific utility's needs.

Field PDA
The configuration is performed by the T2 Field PDA (FPDA). ***Refer to the FPDA Manual for detailed instructions on the configuration process.***

Configurable Parameters
The following items are configurable on the M2 radio:

Meter Settings
This screen allows the user to customize the settings the radio uses for the meter interface.

Transmit Settings
This screen allows the user to customize the settings the radio uses during its RF transmission.

Log Settings
This screen allows the user to customize the settings the radio uses during its data functions:
- Datalogging
- Leak Detection
- High Usage
- Backflow
- Zero Usage

M2 Configuration Parameters

Meter Settings

ID Type
Input Type
Encoder Value
Pulse Value
# of Encoder Digits
Meter Units
Meter Size
Meter Type
Meter Read (Pulse Inputs)

Transmit Settings

Transmit Scaling
Transmit Period
Group ID (extended ID)

Log Settings

Query Interval
Log Interval.

Leak Detection
- Leak Window
- Leak Period

High Usage
- High Usage Threshold
- Conservation Days

Backflow Detection
- Trigger level

Zero Usage
- # of Days for trigger

Meter Reading

Local Data Access

The M2 radio can be read locally via the FPDA or the H2 handheld.

All configuration, meter reading and datalogs are accessible with the PDA software, the H2 software or with the G2 software

Meter Reading PDA Screen

Meter Statistics PDA Screen

Meter Reading H2 Handheld Screen

Datalogging

The M2 radio logs data as an enhanced data function.

The basic data functions of the M2 radio – leak detection, backflow, high usage – are all detectable through the normal remote AMR operations (via the reading system).

The datalogging function offers a first-hand customer-service tool to examine the consumption pattern of a specific meter. For instance, if a customer has been flagged as having a possible leak, the water utility can use the FPDA, H2 or G2 to download the meter/radio's data and immediately discuss the site's usage data.

The FPDA, H2 and g2 will allow the user to view the data in a time bucket format (2, 4, 6, 12 or 24 hr) consumption bar chart format or in a flowrate line graph (for pulse-based systems only)

Data Logging PDA Screen

RF Operations
- Normal AMR Reading

The M2 radio transmits its RF signal on a regular interval (set by the transmit interval). The data is received by the R1 or R2 mobile AMR receiver. The R2 is a transceiver which provides the two-way capability for the G2 software.

The following data is available through the RF transmission:

- Meter Reading
- ID Number
- Leak Detect Flag
- Backflow Flag
- High Usage Flag
- Zero Usage Flag
- Low Battery Flag
- Register Fault Flag
- Register Communications Status

G1 AMR Screen

G2 AMR Screen

BATTERY

The M2 radio has a replaceable battery.

Battery Specifications

Mfg: Tekcell
Type: Thionyl Lithium Chloride
Size: D-cell
Capacity: 19.5 A-hr

Battery Life

All battery calculations include a environmental impact factor and use a baseline of regular function usage (PDA reads, datalogging, etc.)

The M2's transmit period is directly related to the battery life of the M1 radio. The RF transmission is the largest power consumer and thus drives battery life.

Check with Transparent Technologies for a detailed battery life calculation based on specific configurations.

Battery Replacement

Transparent Technologies can provide replacement batteries for M2 radios.

The battery is replaced by first removing the battery cover and then removing the battery cell. The battery is connected to the board with a quick disconnect plug. Some versions do not have a connector. In these cases, the battery wires can be cut and spliced with standard gecap connectors.

The replacement battery will come with the identical plug.

Once the replacement battery has been re-installed, the battery chamber will need to be filled with commercial grade silicone filler for waterproofing.

APPENDIX

FCC Information

Information to user. - The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Special accessories.
(a) Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors, are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e., shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer, without additional charge, at the time of purchase. Information detailing any alternative method used to supply the special accessories shall be included in the application for a grant of equipment authorization or retained in the verification records, as appropriate.

The party responsible for the equipment, as detailed in §2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of the text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.
(b) If a device requiring special accessories is installed by or under the supervision of the party marketing the device, it is the responsibility of that party to install the equipment using the special accessories. For equipment requiring professional installation, it is not necessary for the responsible party to market the special accessories with the equipment. However, the need to use the special accessories must be detailed in the instruction manual, and it is the responsibility of the installer to provide and to install the required accessories.
(c) Accessory items that can be readily obtained from multiple retail outlets are not considered to be special accessories and are not required to be marketed with the equipment. The manual included with the equipment must specify what additional components or accessories are required to be used in order to ensure compliance with this part, and it is the responsibility of the user to provide and use those components and accessories.
(d) The resulting system, including any accessories or components marketed with the equipment, must comply with the regulations.

FCC Definitions

Class A digital device. A digital device that is marketed for use in a commercial, industrial or business environment, exclusive of a device which is marketed for use by the general public or is intended to be used in the home.

Class B digital device. A digital device that is marketed for use in a residential environment notwithstanding use in commercial, business and industrial environments. Examples of such devices include, but are not limited to, personal computers, calculators, and similar electronic devices that are marketed for use by the general public.

> **NOTE:** The responsible party may also qualify a device intended to be marketed in a commercial, business or industrial environment as a Class B device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B digital device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B digital device, regardless of its intended use.

For a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:
> This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:
> This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
> - Reorient or relocate the receiving antenna.
> - Increase the separation between the equipment and receiver.
> - Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
> - Consult the dealer or an experienced radio/TV technician for help.

The provisions of paragraphs (a) and (b) of this section do not apply to digital devices exempted from the technical standards under the provisions of §15.103.