PRELIMINARY
NEW

WORLD'S FIRST MULTI-BAND TRANSCEIVER
(TX, RX., RPR OR TR) FOR 315, 434, 868, 915 BANDS
FREQUENCY HOPPING FOR OEMS & ENDUSERS

MODEL MBTR

1.25 X 1.25″

P.C. Mount

FEATURES:
*Up To 100mW Output
*Up To 1000ft. Range
*1μA Stand-By Current
*4 Inputs and 4 Outputs
*Virtual Wire™ Mode
*Quick to Worldwide Market With
  Same Unit
*High R.O.I.
*3-24VDC & 90-265VAC Power
*7 Packages, Naked to E.Proof

APPLICATIONS:
*GPS Tracking *AMR *Silos *Cranes
*Hazardous Areas *Security Products
*Heating-Cooling *Pressure *Flow Rate
*Under-Over Voltage *Frequency *pH
*Event *%RH Controllers *Level *Serial
Communication *Pumps, Conveyors, Mo-
tors *Cargo Ships, Trailers *Smoke, CO, LPG,
Methane I.R. Gas, Detectors, Tally Polling,
Battery Operation

2 X 2.5 X 4″

NEMA 4X Panel/Pipe/ Conduit Mount

DESCRIPTION
Finally a truly universal **Wireless** system that complies to any country's R.F. requirement! **OTEK's** new **MBTR** can be ordered with any power, band, and operation as permitted by the country that is in use. This means that your product does not need to be changed at all! The same **P.C.B.** and **I/O** are used for all bands and due to **FCC** rules **OTEK** must program the **MBTR** for the specific permissible bands, output power, and operational mode (see License).
The T & R: The **MBTR** is available as transmitter only (**T**), as receiver only (**R**), as a repeater (**RPR**) or as a transceiver (**TR**). As a "**T**" the unit accepts up to 4 different inputs from **dry contacts** or push buttons (keyfob) or 3V logic and transmits the "**ON**" or "**OFF**" state of the inputs individually coded. As an "**R**" the unit decodes the specific input data and turns "**ON**" or "**OFF**" its **O**pen **C**ollector **T**ransistor (**O.C.T.**), its 3V TTL logic, or its relay (depending on the output type you select).
The "RPR": The repeater almost doubles the range per unit. The "**RPR**" can also be used as "**T**" overriding its receiving function so any "**RPR**" can be used as an Alarm/Data originator and the other "**RPR**"s as relays of the **ID** and data to the master receiver.
The "TR": As a transceiver (TR) the **MBTR** is available in 2 versions.

A. With **SPI** (4 wire) **I/O** and **No** microcontroller. This means that you write your own program with OTEK's instructions and benefit from propriatory design and lower cost, but you'll have to get your own **FCC** license.
B. With **UART** I/O, in this configuration the **MBTR** does all the work for you, all you need to do is interface it to your **UART** and follow **OTEK's** list of commands. **FCC** license is proprietary to **OTEK** and **OTEK** transfers it to you at no cost upon receipt of your PO, payment and affidavit of use. This will save you thousands of dollars and months of bureaucratic red tape. The **UART** can be disabled to use as Virtual Wire™.

LICENSE:
OTEK only licenses the **FCC** approved bands and output power per Part 15.247 (902-928MHz, soon for 2.4GHz) or Part 15.231 (315 and 433MHz periodic operation). Any other non-FCC approved band or power ordered must be accompanied by an officer's signed affidavit that the unit's will not be used within **FCC** regulated areas and that the user is responsible for obtaining the license from the country/countries to be exported to. No Affidavit-No Order Entry.

How it works:
The **MBTR** series uses internally controlled frequency hopping technique and programmable output power P.A. as well as error checking to insure reliable communication over the specified range. For extended ranges it is permissible to increase the gain

1.5 X 1 X 3″

Plastic Panel Mount

1.5 X 1 X 3″

Metal Panel Mount

Key-FOB Transmitter

3 X 6 X 6″ Sanitary to 250⁰F Steam Panel/Pipe Mount

4 x 5 x 5″ Explosion Proof

If You Don't See It Ask For It!

https://www.otekcorp.com

520-748-7900
FAX: 520-790-2808
E-MAIL:sales@otekcorp.com
http://www.otekcorp.com

OTEK™ CORP.
SINCE 1974

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TUCSON, AZ. 85714 U.S.A.
MADE
IN
USA

of the unit by using a higher gain antenna than the unity gain supplied (contact **OTEK** for more information). Since the **MBTR** has "room to spare" on the "TX" mode when in the 902-928 FH band (100*m*W at present), one could use an antenna with up to 20dBM for the "TX" or "RX" without infringing the law. No restrictions apply to the receiver's gain except for noise amplifications. Consult **FCC** at www.fcc.gov for further details.

The Packages:

A. **"T"**: The transmitter is available in these packages and with these input configurations:

A.1.**"Naked"** P.C.B. with 14 position header to solder or plug in your P.C.B. measuring 1"x1"x0.3" (25x25x8mm) with either

A.1.1 Soldered helical antenna (unity gain) or

A.1.2 With **RPSMA** connector to screw the supplied **WHIP** antenna (unity gain standard). The helical antenna increases the length to 1.7" (43mm) for 868 and 915MHz bands and 2"(50mm) for 315 and 433MHz bands. The **WHIP** antenna increases the length by 4" (100mm) for 868 and 915MHz and by 6" (150mm) for 315 and 433MHz. The antenna connector (**RPSMA**) allows you to install the antenna remotely from the **MBTR** but you'll loose about one (1) dBm per every 3ft (1M) of coax cable. In the Naked configuration the **MBTR**-"**T**" only accepts either dry contact or 3V compatible logic.Power input is limited to either 3V (2.75-3.3V) or 4 to 12VDC.

A.2.**KeyFob:** In this package the **MBTR**-"**T**" contains its own 3V lithium battery in a key chain module only 1.25x2.25x.4" (32x57x10mm) with four (4) buttons. Battery life expectancy depends on the usage (frequency of use and output power) but normally is good for about 1000 operations at intervals of 15 minutes for a duration of 5 seconds or less.Only "**M**" & "**L**" modes are available. See Note 2.4

A.3.**Miniature Case**: (Plastic or Metal): Antenna: **WHIP** only screwed into the built-in RPSMA connector
Power: 3, 4-48VDC and 90-265VAC
Inputs: Dry contact or 3V logic (others on request)
Mounting: Panel or chassis mount only 1x1.5x2.75" (25x38x69mm).

A.4.**Nema 4X**: Only 2x2.5x4" (50x63x100mm) and it is wall, pipe, or panel mount. The 868 or 915 MHz antenna extends the 4" length to 8" (200mm) and 315 or 433Mhz by 6" to 10" (250mm). Power and inputs are the same as for the miniature case (others on request).
NMH: (3A/Hr.) Battery Pack is optional. Duration depends on the power and frequency of transmittion (typical 3+ years).

A.5.**Sanitary**: This case complies to **Steam Wash Down** requirements and withstands up to 250ºF (120ºC) steam or hose down. The antennas extend the height by 4 or 6" (100 or 150mm). The all aluminum, water tight 3x6x6 (75x150x150mm) case can be wall, pipe, or panel mount and has space for up to 3 units.

A.6.**Explosion Proof**: This 5" (125mm) diameter case only 4" (100mm) deep can be pipe or wall mount. The **MBTR** is inside and coupled to the antenna on the tempered glass with **OTEK's** exclusive high throughput technique retaining the agency's classification for Class I, Div 1&2 Hazardous Environments. The antenna swivels 360º for proper orientation and the 1/2 NPT ports (2) can be used to mount it or use the ears. There is space inside the E.P. for **OTEK's** **NMH** battery pack (4.8V @ 3AHR) for many hours of operation since the **MBTR**-"**T**" only consumes 1µA during stand by, 8mA during awake and 70mA worst case at maximum output power (25mA Nominally.

A.7.**Batteries**: How long do they last? How often will the **MBTR-T** transmit? How big is the battery? **OTEK's BP-48-4** is a 4 battery pack with **NMH** batteries of 3A/hr rating, enough for a minimum of 42 hours of continuous (?) operation (3000/70 mA) at maximum power or more realistic over 365 days at 50/ day for 5 seconds at medium power. The battery charger (p/n BC-48-4) is available and don't forget extra batteries p/n NMH1.2-3 (requires 4 each). The battery pack can be included in NEMA 4X, Sanitary and explosion Proof (See Ordering Information.

B. **"R"**: The receivers use the same board as the "**T**" with the same pinout except the inputs become outputs. The "**R**" has 4 miniature **LEDs** on the back that are lit when the transistor outputs are **low**.

B.1.**Naked**: Same options and restrictions as the "**T**" (see A.1.).

B.2.<u>**Miniature Case**</u>: You have the option of either <u>O.C.T.</u> or relays. On the relays you have the option of either normally closed (N.C.) or normally open (N.O.) contacts due to pinout count. **Power**: 3V only for <u>O.C.T.</u>, Isolated 4-48VDC and 90-265VAC for either relays or <u>O.C.T.</u>

B.3.<u>**NEMA 4X Case**</u>: Since all we do is install the miniature case inside the NEMA 4X case, the same options and restrictions of the miniature case (see B.2) apply (also see A.4).
Note: On special request the NEMA 4X can be fitted with 4 each SPDT 10 amp relays, contact **OTEK**.

B.5.<u>**Sanitary Case**</u>: Again we install the miniature case (up to 3 ea.) inside the sanitary case, consequently all the options and restrictions of the miniature case (see A.3 and B.2) apply.

B.6.<u>**Explosion Proof**</u>: (see A.6): The same features of the E. P. for the "**T**" apply here except we don't recommend the battery pack with the relay option since each relay consumes about <u>50mA @ 5VDC</u>. The "**R**" should always be "**ON**" (about 7mA) unless you control it for "stand-by" and "wake-up".

B.7.<u>**Batteries**</u>: Not recommended for "**R**" (see A.6) but if you must, specify at time of ordering (see A.7).

Warning: You **CANNOT** change frequency band and output power. It is done at the factory due to **FCC** and antenna matching.

C. **Repeater (RPR)**
Repeater: In this mode, the MBTR receives data on one frequency channel and transmits it in another in almost Real Time except for the latency and limited by the Data Rate (see specs.). This configuration is useful for doubling the range and/or "**Mesh**" communication techniques thanks to the frequency hopping of the **MBTR**. The "**RPR**" can be automatically switched from "**RPR**" to "**T**" when any one of its 4 inputs is driven "Low" forcing the unit to transmit its ID (Location) and alarm input type (If only I.N.S. would listen, we could detect illegal border crossers "Pronto") to other **RPR** to computer or satellites.

D. **"TR"**: The "**TR**" (Transceiver) uses the same PCB as the "T" or "R" except we populate it differently. If it is ordered for **SPI** I/O (Option S) we don't install the micro, if ordered with **UART** (Option M) and/or other options such as A/D, we install the microcontroller and program it as required.
Pinout: We use the same pinout as the "T" and "R" as much as possible so you don't have to change your PCB except for some possible jumpers if you use all 4 versions on your same product.

D.1.<u>**SPI**</u>: (Option "S") In addition to the 4 SPI I/O the "**TR**" gives you access to other control pins of the internal microcontroller in the R.F. chip, such as valid data or interrupt input, clock out (to synchronize your uC), FIFO interrupt or data filter input or received data clock out, FIFO select input or received data output or FSK data input. With the **SPI** you can control, among other things, the "low bat" detection threshold, sleep, stand-by, and wake-up, status register, P.O.R., 2 each 8 bit register for TX and 16 bit for RX. Sorry, you **cannot** change the band, center frequency, bandwidth or higher output power but you can change down power (**TX**) and the sensitivity of the LNA (as **RX**). Refer to user's manual for more information or get the uC version, it's all done for you or **OTEK** can customize it to your needs. **Don't** forget, all I/O are 3V logic!

D.2. **μC** (Option C): Here we do it all for you! All you need is a 3V logic compatible I/O. This version has many forms of operation all via simple configuration commands and if you don't have a **UART** compatible I/O you can disable it and use the pins as data <u>input</u> and <u>output</u>. Some functions are:

D.2.1.<u>**Virtual Wire**</u>™: Whatever you put at the input, you'll get at the output (3V logic).

D.2.2.***Latched**: A "logic 0" or dry contact close at the inputs (4) will latch the receiver's output until a general <u>Reset</u> command is sent or the "**RX**" manually reset, but you must configure the units for either **TX** or **RX**.

D.2.3.<u>**Start-Stop**</u>: The first "logic 0" pulse at the **TX** will send an "**ON**" command to the **RX** for that specific channel (1 of 4), the second pulse will send a reset command to the **RX** for that channel.

D.2.4.***Momentary**: On falling edge (or contact closure) at the input, the "**TX**" will transmit the "**ON**" signal to the "**RX**" for it to turn its corresponding output "ON" (1 of 4). On the rising edge (or contact opening) the "**TX**" will transmit the "**OFF**" command for the "**RX**" to reset its output(s). That is why we call it **Virtual Wire**™!

* = Only Available modes in "**Key-Fob**" case.

D.2.5. **10 Bit A/D**: The "**MBTR**" has a 4 channel 10 bit A/D that can be enabled to measure (as a "**TX**") and transmit the wireless data to the "**RX**" for it to output it in digital format through its **UART** port. A simple command enables/disables the A/D or converts it to digital I/Os.

D.2.6 **Counter**: A 16 Bit UP/Down Counter/ Timer is available so you can use it as required or as a **PWM** with external circuitry. Again, one **MBTR** should be configured as "**TX**" and another as "**RX**".

D.2.7 **FIFO**: Almost like our **Virtual Wire**™ but you can transmit and receive in "Bursts" up to 8 bit wide and yu can do it in a two way mode by switching the **MBTR** from **TX** to **RX** upon completion of data sent. Remember that the **MBTR** has 2 each, 8 bit storage registers. The first to store incoming data and the second to store outgoing data (FIFO). This can also be used to store "Preamble" and ID data.

D.2.8 **Custom Configurations**: **OTEK** will be happy to customize your confidential propriatory firmware requirements as well as hardware, whether it is one piece or millions. All of our customers are important (we do not check your size).

D.2.9 **Package**: As of this writing, the "**TR**" version of the **MBTR** is only available in "**Naked**" configuration for **OEMs** with either helical or whip antenna and 3V or 4 - 12VDC power. Consult **OTEK** for other packages.

PRELIMINARY SPECIFICATIONS @ 3V, 25^{0}C AMBIENT WARNING: "ESD"

NOTE: See important footnotes that apply to each version as well as the description of Sections A, B, C and D and Ordering Information.

"T" (Transmitter Only: (See General Specifications)

*Input Level: 3V Logic with 47K pull up. **NOTE:** Never exceed the suppply voltage!

*Input Channels: Four (4)

*Power Consumption: Stand-By: 1µA, Idle: 5mA, Transmit: 25mA (maximum power)

*Power Supply Input Range: See Ordering Information and footnotes.

"R" (Receiver Only): (See General Specs)

*Outputs: O.C.T. active low, 30V, 30mA sink (2N3904), 3V Logic Outputs: Active High, 2mA Source, Sink: 3mA.

*Output Channels: Four (4)

*Power Consumption: Stand-by: 1µA, Idle: 5mA, Receiving: 15mA

*Power Supply Input Range: See Ordering Information and Footnotes.

"P"or "S" or "C" Repeater or Transceiver Only":

(See General Specs)

*Inputs & Outputs Levels: 3V logic (Dry Contact OK)

*Switchover Time (TX to RX): 500µS, (RX to TX): 400µS

*Power Consumption: RX 15mA, TX: 30mA, Idle: 5mA

GENERAL SPECIFICATIONS (ALL VERSIONS)

*Carrier Modulation: FSK Frequency Hopping (where applicable)

*Bandwidth (Center): 311-319: (315); 331-439: (433), 861-879 (868), 901-929 (915)

*# Of Hopping Channels: 50 per Part 15.247

*Max. Data Rate: 57.6Kbps, 256Kbps on request

*Agency's Compliance: FCC, ETSI (For Unlicensed Operation) (*1)

*Crystal Frequency: 10MHz (PLL, AFC & AXAC)

*Antenna Drive: Differential, Self-Tuning

*Low Noise Amplifier (LNA): Programmable to 0, -6, -14 & -20dB

*Data Registers: TX: 2 ea. 8 Bit, RX: 1ea. 16 Bit (FIFO)

*Wake-Up Timer: Programmable from 1mS to 31 days or On Request

*Power Supply Range: 2.8 to 5.2V (*2)

*Power Consumption: See Individual Versions (T, R or "X") and Ordering Information

*Typical Ranges (Limited by Agency's Regulations) (*1)

    315MHz: Indoor: 300 Ft. L.O.S.: 1000 Ft.
    433MHz: Indoor: 300 Ft. L.O.S.: 1000 Ft.
    868MHz: Indoor: 500 Ft. L.O.S.: 2000 Ft.
    916MHz: Indoor: 500 Ft. L.O.S.: 2000 Ft.

*Low Battery Detector: Programmable in 50mV steps from 2.5-5V

*Logic Levels: Low: <1V, High: >2V

*Digital Inputs Current: <1µA, Digital Outputs Current: <2mA

*Receiver's Sensitivity: -109dBm

*Transmitter Output Power Range: 20 to -20dBm factory set for maximum allowed by agency for band used, down programmable (*1)

*P.O.R. 100mS max.

*SPI: To Industry's Standard(S)

*UART: To Industry's Standard (ASCII) (C)

*3V Logic (Non-UART): Unrestricted (Virtual Wire™)

*Programmable Addresses (ID): 256 (Option "C")(*3)

*Polling (RTS): 1-9 Readings (Option "C") from RX to TX

*A/D: 10 Bit Resolution, 0-2VDC F.S. Input (Option "C")

*Transceiver's Operating Modes: See Par. D.2 Field Configurable

NOTES: (S) = SPI Version, ("C") = µC Version, (T) = TX Only, (R) = RX Only, (TR) = Transceiver, (P) = Repeater

IMPORTANT NOTES:

(*1) = **OTEK** only supplies licensed units compliant to FCC for use in U.S.A. For Bands 315, 433 and 915MHz, restricted per Part 15.247 & Part 15.231. It is your responsibility to comply with the **LAW**. Per Part 15.231 (315 & 433MHz Bands), You **Should NOT** Transmit: Voice, Video, True Variable Data or transmit more than five (5) seconds. See www.FCC.gov
868MHz versions are **NOT** permitted in U.S.A. (as of this writing). OTEK does not hold a license for any other Country or is responsible for the use of its products. Orders of versions outside **FCC** regulations (for other Countries use) must be accompanied with an **Affidavit** of "**Not For Use Within U.S.A. or its Possessions**" or the P.O. will be rejected.
(*2) Power supply range is for 3V nominal
(*3) All units shipped with default address 000000 unless specified at time of ordering (field selected).

MECHANICAL DATA

ORDERING INFORMATION FOR MODEL MBTR

02-03-06

| | 1 | 2 | 3 | 4 | 5 | 6 |

Model: **MB-** ☐ ☐ ☐ ☐ ☐ ☐

MODE (1)
T .... Transmitter Only
R .... Receiver Only
P .... Repeater
S .... Transceiver SPI I/O
C .... Transceiver μC UART I/O
9 .... Custom (Specify)

POWER & CASE ANTENNA (2)
00 .... 3V & Naked & Helical
01 .... 3V & Naked & Whip
02 .... 4-12V & Naked & Helical
03 .... 4-12V & Naked & Whip
04 .... KEY-FOB "T" Only
05 .... 3V & Plastic Case.
06 .... 4-12V & Plastic Case
07 ....3V & Metal Case
08 .... 4-12V & Metal Case
09 .... Custom (Please Specify)
10 .... 3V & NEMA 4X Case
11 .... 4-12V & NEMA 4X Case
12 .... Batt. Power & NEMA 4X Case
13 .... Isolated 5V & Plastic Case
14 .... Isolated 12V & Plastic Case
15 .... Isolated 24V & Plastic Case
16 .... Isolated 48V & Plastic Case
17 .... Isolated 90-265VAC & Plastic Case
18 .... Isolated 5V & Metal Case
20 .... Isolated 12V & Metal Case
21 .... Isolated 24V & Metal Case
22 .... Isolated 48V & Metal Case
23 .... Isolated 90-265VAC & Metal Case
24 .... Isolated 5V & NEMA 4X Case
25 .... Isolated 12V & NEMA 4X Case
26 .... Isolated 24V & NEMA 4X Case
27 .... Isolated 48V & NEMA 4X Case
28 .. Isolated 90-265VAC & NEMA 4X Case
30 .... 3V & Sanitary Case
31 .... 4-12V & Sanitary Case
32 .... Isolated 5V & Sanitary Case
33 .... Isolated 12V & Sanitary Case
34 .... Isolated 24V & Sanitary Case
35 .... Isolated 48V & Sanitary Case
36 .... Isolated 90-265VAC & Sanitary Case
37 .... Battery Power & Sanitary Case
38 .... 3V & Explosion Proof
40 .... 4-12V & Explosion Proof
41 .... Isolated 5V & Explosion Proof
42 .... Isolated 12V & Explosion Proof
43 .... Isolated 24V & Explosion Proof
44 .... Isolated 48V & Explosion Proof
45 . Isolated 90-265VAC & Explosion Proof
46 .... Battery Power & Explosion Proof

CERTIFICATE OF COMPLIANCE (5)
0 .... None
1 .... Included

OUTPUTS (4)
0 .... None (For Transmitter)
1 .... 3V Logic
2 .... Open Collector Transmitter (O.C.T.)
3 .... Relays N.O. Contacts
4 .... Relays N.C. Contacts

FREQUENCY BAND (3)
0 .... 315MHz
1 .... 433MHz
2 .... 868MHz
3 .... 915MHz

NOTES: (Read Description Conditions & Specifications Before Ordering)

1. "Transceiver μC" (Option C) UART can be disabled to accept Non-UART Data.
2.1 Naked Mounts ertical on your P.C.B. For horizontal mount use Option 09 and specify horizontal mount.
2.2 Only the naked can be ordered with helical or whip, others only with RPSMA connector and whip.
2.3 Up to 3 units can be fitted in Sanitary case with external power or 1 with battery power.
2.4 **"KEY-FOB"** only available with "Momentary" or "Latch" functions, specify.
3. 868MHz (Option 2) not for U.S.A. Requires Affidavit, "T" & "R" must have same band.
4. Transmitter has no outputs, use 0 option. Relays not available in NAKED case, O.C.T. not available with "P", "S" or "C" modes. For transceivers (S or C) and repeater (P) use 1 option.
5. See Note (*1) P. 5
6. Limited Lifetime Warranty

NOTES ON ACCESSORIES:

Battery Charger: P/N BC-48-4 (Charges Up To 4 Simultaneously) (8 Hrs.)
Extra Battery Pack: P/N BP-48-4 (4.8V @ 3A/Hr.)
Extra Batteries: P/N NMH-1.2-3 (12/V @ 3A/Hr.)