

RECEIVER- CONTROLLER

MODELS RC-1T2 & RC-1T2-R

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CONTROL INDUSTRIES, INC.

Control Industries
409 Lafayette Ave
Urbana, Ohio 43078

CONTROL INDUSTRIES

409 LAFAYETTE AVENUE

• URBANA, OHIO 43078

• PHONE 513-653-7694

OPERATING, MAINTENCE, INSTALLATION INSTRUCTIONS

FOR RECEIVER-CONTROLLER MODEL RC-1T2 AND RC-1T2-R

GENERAL:

The model RC-1T2 has been specifically designed to meet airport requirements for reliable control of runway and approach lighting. This unit will allow the approaching pilot functional control of the airport and/or approach lighting system. The RC-1T2 is enclosed in a weather-proof water-tight housing and is conservatively designed for continuous out-door operation.

ELECTRICAL:

The receiver is of combination field-effect transistor and integrated-circuit design. The sensitivity is adjustable from 5 to 30 microvolts as desired by the user, permitting a control range of 1 to 20 miles. Receivers are shipped normally adjusted to a sensitivity of 10 microvolts. The unit is designed to operate from 120 VAC $\pm 15\%$ 60 HZ single phase power.

THEORY OF OPERATION:

The system is activated upon receiving a series of five pulses of R.F. energy within a five second time period. The RC-1T2 will close a 10 Amp. control relay, and the RC-1T2-R will close a 30 Amp. power relay for a period of 15 minutes. The solid state timer will operate for 15 minutes, after which it will revert to the original "off" condition. The timer can be reset to the full 15 minute cycle at any time during the timing period upon the receipt of an additional five pulses of R.F.

The solid state Receiver-Controller is composed of four printed circuit cards including an electronically regulated power supply and maintenance test oscillator. The following describes the theory of operation of each of the Receiver-Controller basic elements. Reference: Functional Diagram Fig. A.

RADIO FREQUENCY CARD (C.I. PART #11-0155)

The radio receiver is a single conversion superheterodyne design operating at a nominal R.F. frequency within the VHF band of 118.0 to 136.0 MHz. An IF frequency of 21.4 MHz is utilized with the bandwidth controlled by a 6 pole crystal lattice filter. This filter establishes nominal -60 db rejection at adjacent channel frequencies of ± 25 KHz or more. It also establishes an on-frequency bandwidth of nominally ± 9 KHz at the -6 db points.

RADIO FREQUENCY CARD (11-0155) Continued

Intermediate frequency amplification is provided in part by a dual gate FET first IF amplifier. A communications type integrated circuit provides the remainder of the IF gain, AM detection, AGC, and audio output. The audio output is buffered and delivered to a service jack for maintenance and test purposes. The AGC Voltage controls the overall gain of the receiver and is also used to sense the presence of a desired signal. The AGC voltage level is amplified and utilized to change the state of an integrated circuit schmitt trigger. The schmitt trigger is required to condition the incoming RF pulses in terms of amplitude and rise time. It also eliminates the undesirable effects of transmitter modulation. The binary condition of the schmitt trigger is buffered and utilized as the input to the Decoder Card. A red LED indicator is included on the Receiver Card to visibly show the state of the receiver logic. This Receiver Card complies with FCC rules and regulations part 15.

DECODER CARD (11-0066)

The functional purpose of the decoder card is to sense the presence of 5 pulses within a 5 second time period, determine if this condition exists and effect a relay closure. The following is the sequence of operation:

Upon receipt of the first pulse from the schmitt trigger a 5 second time delay period is initiated. This first pulse is also stored in binary counter #1, as are all subsequent pulses. When 5 pulses are received and stored in binary counter #1 its electrical state and connection is such that the three input gate decoder is caused to demand relay control #1 to close relay R1. If the 5 pulses are not received and stored in binary counter #1 within 5 seconds, the 5 second delay circuit causes binary counter #1 to reset to its original condition.

Relay control circuitry is included on the decoder card to match the low impedance relay coils to the high impedance solid state counting devices.

TIMER CARD (C.I. Part #11-0077)

The purpose of the Timer Card in the RC-1T2 is to provide a 15 minute "hold-on" period for Relay R-1. The basic timing of this card is derived from a stable time pulse generator which starts only when 5 pulses are received and decoded by the Decoder Card. The period of the time pulse generator is selected such that counting down by a given constant will produce only one pulse in 15 minute period. The output of the time pulse generator is divided by summation shift register #1 and further divided by summation shift register #2. These registers are identical. Upon total summation (15 minutes) the "off" control SCR circuit is caused to open Relay R-1, thus effecting system "shut down".

TIMER CARD (C.I. Part #11-0077)

To allow for re-start of the 15 minutes timing cycle, a summation re-set circuit is provided to re-set all shift registers to zero. This allows the pilot to re-cycle the system for a full 15 minute period at any time during its activation. The summation re-set circuitry additionally insures that all registers always start from their zero state.

POWER SUPPLY/TEST OSCILLATOR CARD (C.I. Part #11-0088)

A printed circuit board comprises the electronically regulated dual power supply and a crystal controlled test oscillator circuit.

The power supply is composed of a power transformer, bridge rectifier, dual section hum filter and a series pass transistor constant voltage regulator. The supply provides regulated power at 12.0 volts DC. The range of regulation is approximately 95 volts input 50-60 hz. AC to 140 volts. Within this excursion range the D.C. output voltage remains constant. The test oscillator is included within the power supply card to provide a complete system test from RF input to output relay closure. The oscillator is a third mode crystal circuit activated by the red test switch button.

The test signal frequency generated is the same as that for which the receiver is designed and is provided for use by maintenance personnel to check for proper operation of the system.

TROUBLE ANALYSIS:

A malfunction chart including several possible failure modes is supplied to assist the technician in analyzing the probable cause. The receiver-controller is warranted for one year from date of purchase. Failures not caused by improper installation or abnormal treatment will be corrected by the manufacturer free of charge within the warranty period.

TROUBLE ANALYSIS CHART:

The following tabulation will provide guidance for recognizing possible trouble and correction.

MALFUNCTION	POSSIBLE CAUSE	TEST AND REMEDY
AC voltage present but no operation	Open 1 A. Fuse Bad AC Switch	Test & Replace Test & Replace
No DC LED indication	Defect in power supply, electronic board, power trans- former or series regulator transistor	Return receiver to manufacturer for service

TROUBLE ANALYSIS CHART (continued)

MALFUNCTION	POSSIBLE CAUSE	TEST AND REMEDY
AC-DC both O.K., no binary LED indication, no audio indication	Defect in receiver card part 11-0155	Replace card - re-test. Send defective card to manufacturer for repair or replacement if in warranty
AC-DC both O.K., no binary count. Audio O.K.	Defect in decoder card part 11-0066	Replace card - re-test. Send defective card to manufacturer for repair or replacement if in warranty
AC-DC both O.K., Binary count O.K. Relay closures nor- mal - No output voltage control line	Open SA SLO BLO Fuse	Test & Replace fuse with same type only
Failure to re-set binary indicators after 5 seconds	Defective Decoder card, part 11-0066	Use replacement card and re-test
Fails to turn off after 15 minutes	Defective Timer Card, part 11-0077	Use replacement card and re-test. Return defective card to man- ufacturer for repair or replacement if in warranty
	Defective Relay R1	Replace relay with same original manufacturer's part number (R-1012D)
AC-DC both O.K. Binary indications normal - output indicator LED Fail to activate	Defective Relay R1	Replace relay with original part number (R-1012D) and re-test

MAINTENANCE:

The Model RC-1T2 is designed to require a minimum of maintenance under all ranges of service conditions. There are no moving parts except the output contactor relays. With proper installation, no abuse or tampering, the unit should deliver at least 10,000 hours of trouble free operation.

MAINTENANCE CONCEPT:

The unit may be maintained readily by technician level personnel. There should be no attempt to repair a defective solid-state card in the field. A stock of one each substitute cards should be retained to verify a suspected defective card by simple substitution procedures. All other elements of the receiver-controller may readily be checked utilizing normal electrical test procedures involving no special testing equipment other than a standard volt-ohmmeter. A standard head-set may be used to monitor the receiver at the audio jack.

OPERATING CHECKOUT:

The service technician may determine proper operation of the receiver-controller by completing the following check list:

- (1) Check the presence of primary line voltage as measured between input terminals marked 115V AC and neutral.
- (2) Press AC power switch to "on" and observe DC power indicator LED inside controller housing. Illumination of DC indicator LED assures proper power supply operation.
- (3) Depress red test button five consecutive times within five seconds. This action should cause binary LED indicators to follow the pattern described in Fig. D and result in closure of Relay R-1 and illumination of the red LED indicator adjacent to relay R-1.
- (4) After elapse of 5 seconds all binary indicators should extinguish.

The above procedures accomplish a complete operating check of all elements and functions of the Receiver-Controller RC-1T2.

SENSITIVITY ADJUSTMENT:

There is one potentiometer located on the Radio Frequency card which will control the sensitivity. The controller is shipped with the sensitivity adjusted to 10 microvolts to trip the binary counters. Minor changes in sensitivity can be accomplished by adjusting the schmitt trigger potentiometer located at the top of the receiver card. Counter-clock-wise movement increases sensitivity. CAUTION: Do not advance the schmitt trigger adjustment further counter-clockwise to obtain sensitivities higher than 2 microvolts. This can lock up the schmitt trigger and render the receiver in-operative. No adjustments should be made with out an accurate signal generator.

INSTALLATION:

The receiver-controller RC-1T2 is designed for all-weather outdoor unattended operation. The weather-tight case will repel the elements and no shelter is required.

Control and power lines should enter by means of the 1/2 inch conduit entry in the bottom of the unit. A maximum of three conductors is required to complete the installation.

The terminal block is clearly marked with neutral and 115V AC terminations. Attention to correct connection of the neutral is important. Failure to observe these instructions will not necessarily damage the equipment but will result in the undesirable switching of the neutral instead of the "hot" side of the line.

For outdoor installations the antenna is attached directly to the antenna mounting supplied on the top surface of the enclosure. For outdoor installations a remote ground plane antenna is required. The antenna cable enters the enclosure by means of the water-tight squeeze connector normally supplied for such installations. Standard procedures for attaching coax fittings should be observed.

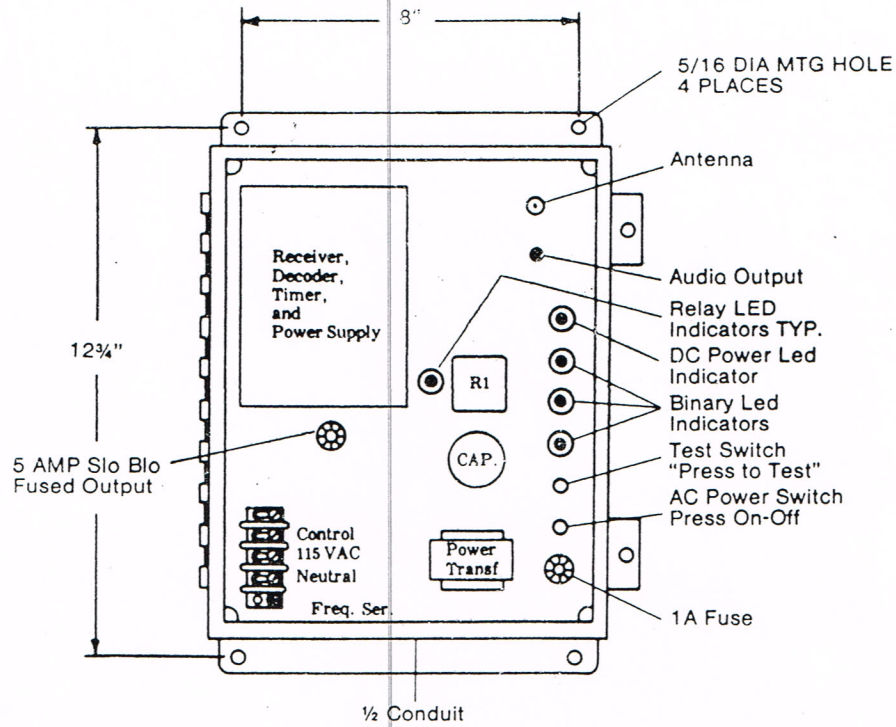
SPECIFICATIONS:

Input	120 VAC + 15% 60 HZ
Output	10 amp relay contact
Size	10"W x 12" H x 5"D
Mounting	Any flat surface
Weight	Approximately 15 lbs.
Temperature	-55 degrees C to +55 degrees C
Frequency	Within VHF range as specified by customer
Warranty	2 years from date of purchase
Antenna	VHF whip or ground plan for remote installation

PARTS LIST

PART	NO.	SUPPLIER
POWER TRANSFORMER	1	SIGNAL TRANSFORMER 241-5-16
FILTER CAPACITOR	1	MALLORY WP201.5A
BASE ASSEMBLY	1	CONTROL INDUSTRIES NO. 11-0033
RECEIVER BOARD	1	CONTROL INDUSTRIES NO. 11-0155
DECODER BOARD	1	CONTROL INDUSTRIES NO. 11-0066
TIMER BOARD	1	CONTROL INDUSTRIES NO. 11-0077
POWER SUPPLY BOARD	1	CONTROL INDUSTRIES NO. 11-0088
POWER RELAY	1	CONTROL INDUSTRIES NO. R1012D
R-C FILTER	1	CONTROL INDUSTRIES NO. 1014
L-C FILTER	2	CONTROL INDUSTRIES NO. 1016
POWER TRANSISTOR	1	2N4898
FUSE	1	LITTLE FUSE MDLS
FUSE	1	LITTLE FUSE MDL 1
LIGHT EMITTING DIODE	5	NSC NSL-5023
THERMOSTAT	1	KLIXON MI-060-040-185
RESISTOR	2	DALE RH-50
ENCLOSURE	1	HOFFMAN CH-1210

MOUNTING PLAN, PICTORIAL
FIG. C



INTERCONNECTING WIRING DIAGRAM
FIG. I

