TONO

COMMUNICATIONS COMPUTER

Θ-350

INSTRUCTION MANUAL

(THE SECOND PRINT)

TONO CORPORATION

98 MOTOSOJA-MACHI, MAEBASHI-SHI, 371, JAPAN

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1. PRECAUTION

1. Before operating the set, please read this INSTRUCTION MANUAL thoroughly.
2. Take care to properly connect in the connection to the input circuits and output circuits. Input signal and load should be within the ratings.
3. Voltage of DC power supply should be within the range of DC 11V----14V.
4. Where the input impedance of the TV set is 300 ohms, (not 75 ohms) put a matching transformer of 75 ohms : 300 ohms between the Theta-350 and the TV set.
5. The Theta-350 should be installed at a well-ventilated dry place not exposed to the direct rays of the sun with special care for heat radiation.
6. Built-in demodulator can be used with 150 Baud maximum.

2. FEATURES

1. Communications Computer Theta-350

   Due to the most up-to-date computer technology, one piece of equipment can now handle receiving in CW, RTTY and ASCII.

2. VHF and Composite video output provided

   Both a home TV set and video monitor outputs are provided for display purposes.

3. Printer interface

   Centronics para. Compatible interface enables easy connection of a low-cost dot printer for hard copies. Can be connected directly with HC-800 & HC-900.

4. Wide range of receiving speeds

   Automatic CW speed adjustment and 8 Communication speeds for RTTY and ASCII. The multiple speed feature makes the Theta-350 ideal for Amateur, business and commercial use.

5. Built-in demodulator for high performance

   Three-step shift (either 170Hz, 425Hz, 850Hz) can be obtained using either High Tones or Low Tones. Manual adjustment is available by FINE TUNING Control.

6. Anti-Noise

   A new anti-noise circuit prevents garbled message when there is no signal.

7. Large capacity display memory

   The two-page display memory contains 32 characters x 16 lines per page. Page selection is operated via the keyboard.

8. WORD-WRAP-AROUND function

   Word-wrap-around prevents the last word of the line from splitting in two.

9. MARK-AND-BREAK (SPACE-AND-BREAK) system.

   Either mark or space tone can be used to copy RTTY.

10. Monitor circuit

    A built-in monitor circuit with an automatic receive switch enables checking of the receiving state. It is possible to check the output of the mark filter, the space filter and AGC amplifier prior to the filters.

11. CW practice function

    The Theta-350 reads data from the key and displays the characters on the screen.

12. Cross-pattern checking output terminal

    Provision has been made for attachment of an oscilloscope to aid tuning. This supplements the tuning LED and audio monitor provided in the system.

3. LOCATION AND FUNCTION CONTROL

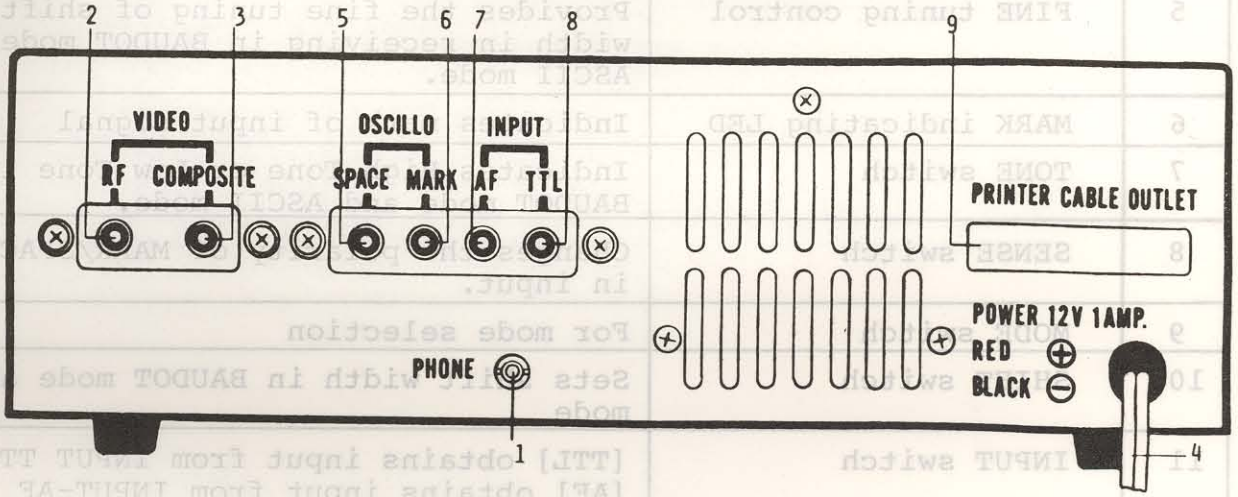


Figure 1

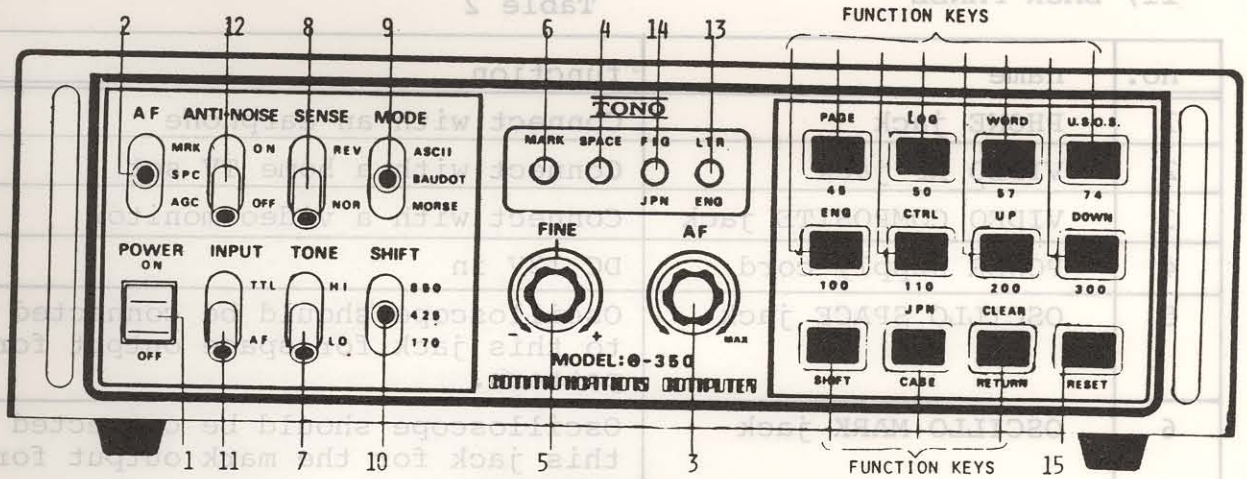


Figure 2

i) FRONT PANEL

Table 1

no.	name	function
1	POWER switch	
2	AF switch	[AGC] output from AGC can be monitored. [MARK or SPACE] output from respective filters can be monitored.
3	AF volume control	Controls the volume of a monitor speaker
4	SPACE indicating LED	Indicates space of input signal
5	FINE tuning control	Provides the fine tuning of shift width in receiving in BAUDOT mode and ASCII mode.
6	MARK indicating LED	Indicates mark of input signal
7	TONE switch	Indicates High Tone or Low Tone in BAUDOT mode and ASCII mode.
8	SENSE switch	Changes the polarity of MARK/SPACE in input.
9	MODE switch	For mode selection
10	SHIFT switch	Sets shift width in BAUDOT mode and ASCII mode
11	INPUT switch	[TTL] obtains input from INPUT TTL jack [AF] obtains input from INPUT-AF
12	ANTI-NOISE switch	Helps to prevent garble when there is no signal.
13	LETTER indicating LED	Indicates Letter case in RTTY
14	FIGURE indicating LED	Indicates Figure case in RTTY
15	RESET key	Put the set in the initial state.

ii) BACK PANEL

Table 2

no.	name	function
1	PHONE jack	Connect with an earphone
2	VIDEO RF jack	Connect with a home TV set
3	VIDEO COMPOSITE jack	Connect with a video monitor
4	POWER supply cord	DC 12V in
5	OSCILLO SPACE jack	Oscilloscope should be connected to this jack for space output for cross-pattern.
6	OSCILLO MARK jack	Oscilloscope should be connected to this jack for the mark output for cross-pattern.
7	INPUT-AF jack	Connect to EXT SP terminal or line output of the receiver
8	INPUT-TTL jack	For non-modulated signals in CW, BAUDOT or ASCII and when using with a hand key.
9	PRINTER CABLE OUTLET	

4. ACCESSORIES SUPPLIED

Instruction Manual	1
Pin Plug	4
Earphone Plug	1
Coaxial Cable	4 m

5. CONNECTION

BASIC SYSTEM

i) Power Supply

Before connecting a power lead to your DC power supply, the setting of the voltage must be within the range of DC 11V - 14V. After confirming that the DC source switch and the POWER switch of the Theta-350 indicates OFF, connect a red power lead of the Theta-350 to a plus (+) terminal of the DC power source; a black power lead to a minus (-) terminal.

ii) TV Set

1. Solder an ancillary coaxial cable and a pin plug as shown in Fig. 3. After having soldered, connect the pin plug to the RF pin jack of the Theta-350 and the other end of the coaxial cable to an antenna terminal of a home TV set. Tune TV set to CH 4. (CH3 in USA)

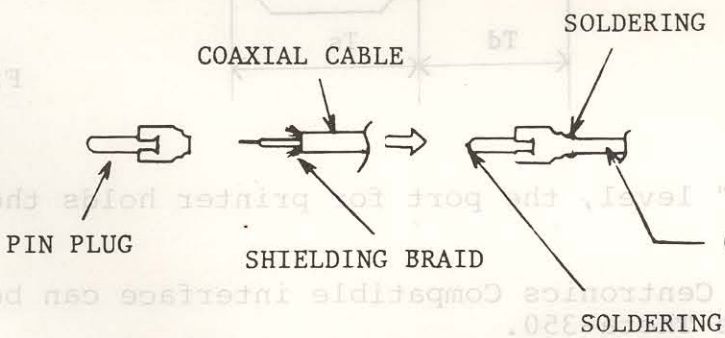


Figure 3

or 2. Connect the pin plug to COMPOSITE pin jack for a display monitor.

iii) Receiver

If you use a transceiver for receiver, make sure SWR is as follows to enable correct operation.

OUTPUT	SWR
10 W	--- 1.5
10W -- 100 W	--- 1.3
100W -- 500 W	--- 1.1

Table 3

EXPANDED SYSTEM

i) Oscilloscope

Output impedance for oscilloscope is 200K ohms. Use an oscilloscope of which input impedance is over 1M ohms.
Output for oscilloscope is about 1.2 Vp-p. Large cross-pattern is not otainable without amplifier in Horizontal amplifier of the oscilloscope.

ii) Printer

Connect a printer to CN6 pin header on CPU board. The fan-out of each pin is 5 standard TTL loads. Avoid overload. When $\overline{\text{READY}}$ is "L" level, timing of data for printer is as follows:

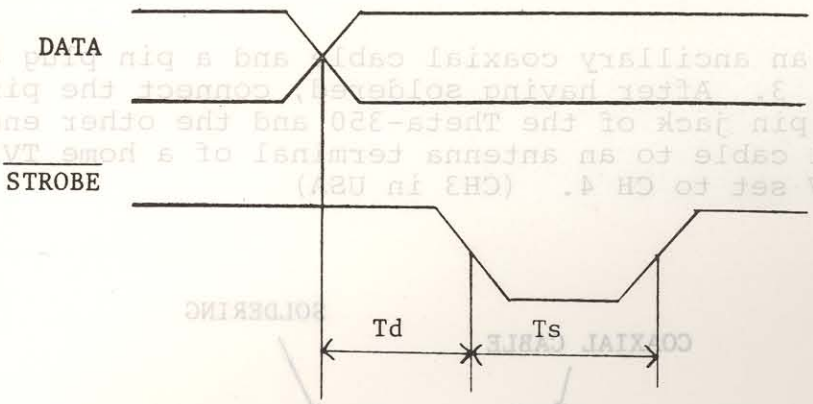


Figure 4

When $\overline{\text{READY}}$ is "H" level, the port for printer holds the previous data.

Any printer with Centronics Compatible interface can be connected directly with the Theta-350.
We recommend the TONO Dot Matrix Serial Impact Printer model: HC-800 and HC-900, which are easy to connect by its special cable connector for the Theta-350. (Refer to Page 17.)

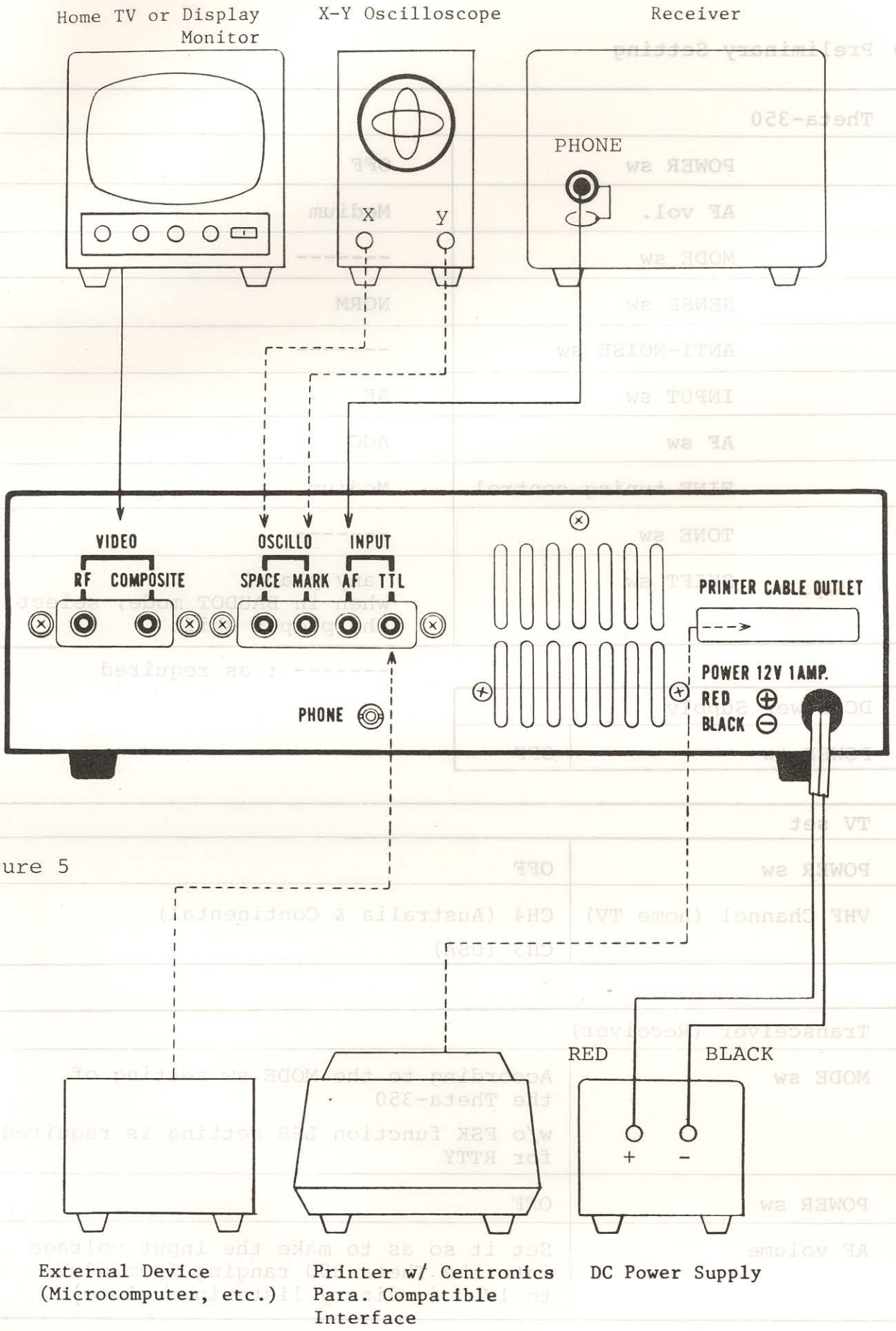

Home TV or Display Monitor
X-Y Oscilloscope
Receiver
PHONE
X
Y
VIDEO
RF
COMPOSITE
OSCILLO
SPACE
MARK
INPUT
AF
TTL
PHONE
PRINTER CABLE OUTLET
POWER 12V 1AMP.
RED
BLACK
RED
BLACK
+
-
External Device (Microcomputer, etc.)
Printer w/ Centronics Para. Compatible Interface
DC Power Supply

Figure 5

6. OPERATION

i) Preliminary Setting

Theta-350	
POWER sw	OFF
AF vol.	Medium
MODE sw	-------
SENSE sw	NORM
ANTI-NOISE sw	-------
INPUT sw	AF
AF sw	AGC
FINE tuning control	Medium
TONE sw	-------
SHIFT sw	(any place) when in BAUDOT mode, select the proper shift

------- : as required

DC Power Supply	
POWER sw	OFF

TV set	
POWER sw	OFF
VHF Channel (home TV)	CH4 (Australia & Continental) CH3 (USA)

Transceiver (Receiver)	
MODE sw	According to the MODE sw setting of the Theta-350 w/o FSK function LSB setting is required for RTTY
POWER sw	OFF
AF volume	Set it so as to make the input voltage into the Theta-350 ranging from 50mV to 1V. (ordinary listening volume)

Table 4

ii) Procedure to power up equipment

Put the power switch ON of :

1. TV set
2. DC power supply
3. Theta-350
4. Transceiver

When you get LTR indicating LED light and indications on the TV screen as shown in Fig. 6A, your Theta-350 is all ready to go!

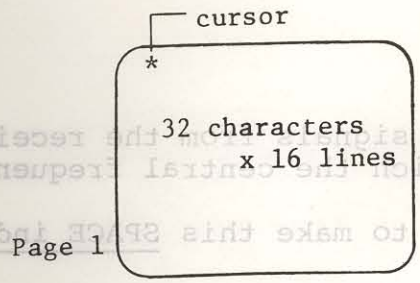


Figure 6A

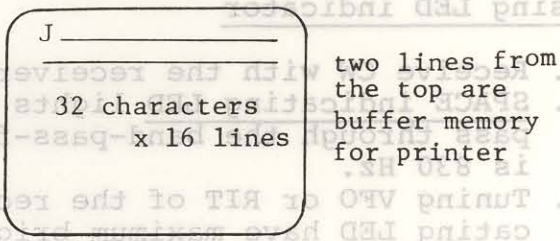


Figure 6B

When in the POWER-ON-RESET or RESET STATE:

1. Speed

Mode	Speed
MORSE	Low Speed
BAUDOT	45.45 baud
ASCII	110 baud

Table 5

2. WORD-WRAP-AROUND ------ OFF
3. UNSHIFT-ON-SPACE ------- OFF
4. SCREEN ---------- Page 1
5. CASE ---------- letters
6. "FF" (ØC) of ASCII is sent to the printer port on the CPU Board, which makes LF until next TOF on the HC-800 & HC-900 printers

iii) CW (Morse) Operation

Speed and Weight Setting

Speed is automatically determined. Dots which are less than 15 msec may be regarded as noise. However, when slow CW is received right after rather quick CW, 2 - 4 characters are required before syncronisation is achieved.

For the faster sync in high speed

Push any key of the middle row. (100, 110, 200, 300)

For the faster sync in low speed

Push any key of the top row. (45, 50, 57, 74)

When the speed of signals suddenly diminishes to less than half, it will sometimes happen that 8 - 12 characters are read as "E" or "T" by mistake. However, correct reading will be obtained with the continuation of the CW signals at the new rate.

Tuning

Using LED indicator

1. Receive CW with the receiver.
2. SPACE indicating LED lights when the CW signals from the receiver pass through the band-pass-filter of which the central frequency is 830 Hz.
3. Tuning VFO or RIT of the receiver so as to make this SPACE indicating LED have maximum brightness.

Using audio level

1. Set AF Switch to SPACE.
2. Output of the band-pass-filter is to be heard.
3. Adjust the receiver so that audio level of the Theta-350 may be maximum.

When the SPACE indicating LED begins to flicker corresponding to signals, the Theta-350 reads properly and will display on the TV screen.
Special characters are to be displayed as shown in Table 6.

SPECIAL CHARACTER	DISPLAY	SPECIAL CHARACTER	DISPLAY
$\overline{BT}$	=	$\overline{KN}$	(
$\overline{HH}$	<	$\overline{AR}$	+
$\overline{AS}$	^	$\overline{VA}$	;
$\overline{AA}$	@		

Table 6

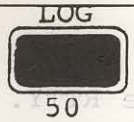
NOTE: Mode change under running condition requires renewal of speed setting.

iv) RTTY (Baudot) Operation

Speed Setting

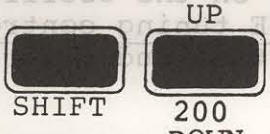
Speed is automatically set at 45.45 baud in the initial state.
Refer to Table for speed selection.

Table 7

Key	Baud	Key	Baud
PAGE 45	45.45	ENG 100	100
LOG  50	50	CTRL 110	110
WORD 57	56.88	UP 200	200
U.S.O.S 74	74.2	DOWN 300	300

NOTE: 45.45 baud is popular among amateurs and 50 baud is widely used in business communications.

Fine Adjustment : Press the following keys at the same moment.



--- speed up (the length of a bit becomes about 0.16 msec shorter per time.)

--- speed down (the length of a bit becomes 0.16 msec longer per time.)

Tuning

1. Tune in RTTY signals with the receiver.
2. Increase the AF output frequency gradually from the lower value with the VFO or RIT, until MARK indicating LED lights.
3. Continue increasing the frequency.
4. Stop increasing the frequency when the MARK indicating LED lights again and comes to light at maximum brightness.
5. SPACE indicating LED lights at this moment when the shift width of RTTY signal agrees with the setting of the Theta-350.

no ↓

5'. If SPACE indicating LED does not light, turn the FINE tuning control to catch the position where it lights.

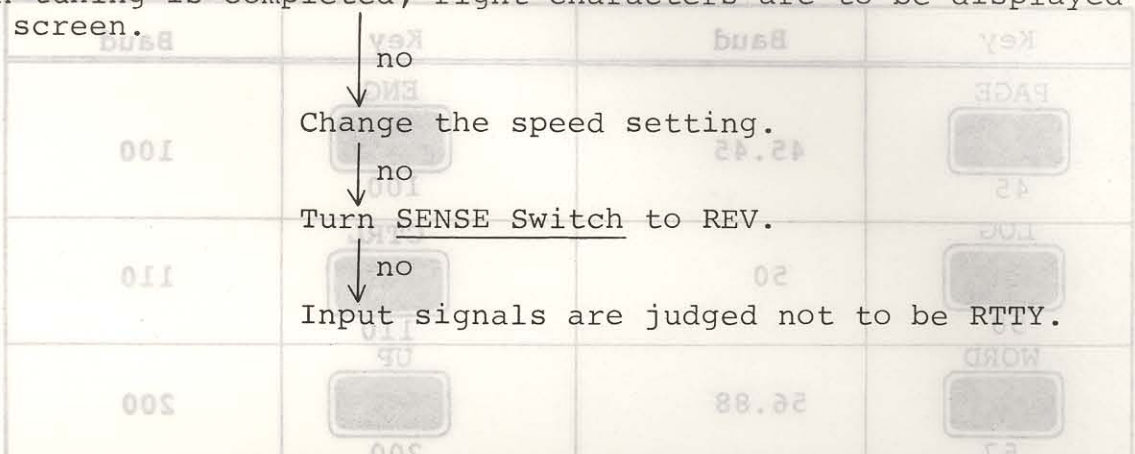
yes → 6.

no ↓

6'. Change the setting so as to make SPACE indicating LED lights and turn the FINE tuning control to make the lighting the brightest.

6. Turn the FINE tuning control and stop it at the maximum brightness of SPACE indicating LED.

When tuning is completed, right characters are to be displayed on the screen.



For amateur communication, 170 Hz shift is most commonly used; for business communication, 850 Hz and 425 Hz shift are widely used. In addition, monitoring of the output of MARK filter and SPACE filter are obtainable by tuning AF Switch to MARK/SPACE. The output of MARK filter and SPACE filter can function in lieu of MARK indicating LED and SPACE indicating LED.

Tuning by Cross-Pattern

In the case of tuning with a cross-pattern made on the oscilloscope, adjust VFO and RIT of a receiver and FINE tuning control of the Theta-350 to make amplitude both in V-direction and H-direction the maximum.

NOTE: Mode change under running condition requires renewal of speed setting.

v) ASCII Operation

Speed Setting

Speed is automatically set at 110 baud in the initial state. Follow the RTTY methods for speed change and selection.

Tuning

Follow the RTTY methods for tuning.

NOTE: Mode change under running condition requires renewal of speed setting.

vi) Special Functions

ANTI-NOISE Circuit

When there are too many errors caused by noise when there is no signal, set the ANTI-NOISE Switch ON.
This circuit may make mistakes with high speed CW (Morse) of which a dot is shorter than 20 msec.

UNSHIFT-ON-SPACE Function (only in BAUDOT)

When error in CASE (LTR or FIG) is often made with a lot of noise, press SHIFT + U.S.O.S 74 at the same moment. UNSHIFT-ON-SPACE Function works and leads the LTR (Letter) case when space is received. To release this function, press these keys again.

CW (Morse) Practice

Connect a hand key with INPUT-TTL jack on the back panel. Set INPUT Switch to TTL.
Manipulate the key, and reading is gained and displayed on the screen. Monitoring sound can be also heard.

Recording of received signals

Recording during receiving is enabled by connecting PHONE jack of the Theta-350 with the microphone terminal of a tape recorder.

Automatic CR+LF after receiving

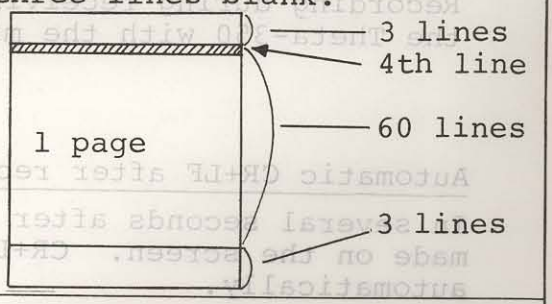
In several seconds after completion of receiving messages, CR+LF is made on the screen. CR+LF signal is to be sent to the printer port automatically.

WORD-WRAP-AROUND

The word-wrap-around function prevents the last word of the line from splitting in two.

Press SHIFT + WORD 57 at the same moment. To release this function, push these keys agin.

Table 8

Key	UNSHIFT	SHIFT Push a respective key together with SHIFT key.
PAGE [ ] 45	To set at 45.45 baud in RTTY and ASCII. Or to set at Low Speed in CW (Morse).	To change the page.
LOG [ ] 50	To set at 50 baud in RTTY and ASCII. Or to set at Low Speed in CW (Morse).	To set at 600 baud in ASCII.
WORD [ ] 57	To set at 56.88 baud in RTTY and ASCII. Or to set at Low Speed in CW (Morse).	To switch WORD-WRAP-AROUND function on/off.
U.S.O.S [ ] 74	To set at 74.2 baud in RTTY and ASCII. Or to set at Low Speed in CW (Morse).	To switch UNSHIFT-ON-SPACE function on/off.
ENG [ ] 100	To set at 100 baud in RTTY and ASCII. Or to set at High Speed in CW (Morse).	To send "ESC [" to make HC-900 in incremental mode and "ESC]" to make it in logic seek mode by turns. In logic seek mode it prints out line by line. When in incremental mode it prints out immediately after receipt of each signal.
CTRL [ ] 110	To set at 110 baud in RTTY and ASCII. Or to set at High Speed in CW (Morse).	In order to avoid printing on folding lines of folded type paper it changes VFU of printer. Adjust the printer head on the 4th line and power up the printer. Change VFU by pressing these keys. The change of VFU makes top three and bottom three lines blank. 
UP [ ] 200	To set 200 baud in RTTY and ASCII. Or to set at High Speed in CW (Morse).	To make the length of a bit about 0.16 msec shorter per time in RTTY and ASCII.
DOWN [ ] 300	To set at 300 baud in RTTY and ASCII. Or to set at High Speed in CW (Morse).	To make the length of a bit about 0.16 msec longer per time in RTTY and ASCII.
JPN [ ] CASE	To change CASE (LTR or FIG) manually in RTTY (Baudot).	To send the signals of SO/SI to the printer:HC-800 and HC-900 in order to make the printings normal/large.
CLEAR [ ] RETURN	To make CR.LF on the screen and send the ASCII signals of CR.LF to the printer.	To clear the screen and the buffer for the printer and send CR.LF signals to the Printer.

7. MAINTENANCE

1. When the Theta-350 stops working because of excessive or inverse power

   Supply a new fuse on the Switch Board if the fuse is gone. The D18 Zener Diode on the CPU Board is possibly destroyed, and in that case, supply a new 18V (Zener Voltage) Zener Diode.

2. When the right display cannot be obtained on the screen because of the frequency of RF output

   Tune with the FINE tuning of the home TV set.
   If it doesn't work, adjust the trimmer capacitor through the hole of the shield box on the CPU board.

3. If the frequency of respective filters in the domodulator has changed

   Adjust the respective variable resistor so that each amplitude at each test point should be as follows:

Table 9

Mode sw	Filter	TONE sw	SHIFT	signals for INPUT-AF	Test Point	Amp.	Center Freq.	Amp. VR
Morse	CW Filter	----	----	830Hz	TP6	2.0Vp-p	VR13	VR14
	MARK Filter	Low Tone	----	1275Hz	TP5	1.6Vp-p	VR11	VR12
		High Tone	----	2125Hz	TP5	----	VR10	----
Baudot	SPACE Filter	Low Tone	170Hz	1440Hz	TP4	1.6V	VR8	VR9
		Low Tone	425Hz	1700Hz	TP4	----	VR7	----
		Low Tone	850Hz	2125Hz	TP4	----	VR6	----
		High Tone	170Hz	2295Hz	TP4	----	VR5	----
		High Tone	425Hz	2550Hz	TP4	----	VR4	----
		High Tone	850Hz	2995Hz	TP4	----	VR3	----

i) AF input signals 0.5Vp-p

ii) FINE tuning potentiometer should be accurately adjusted at the center.

iii) Make an adjustment with the center freq. tuning variable resistor so as to have the maximum amplitude, and then, adjust with the amplitude tuning variable resistor so as to have the proper amplitude.

8. SPECIFICATIONS

1. Code:

   Morse Code (CW), Baudot Code (RTTY), ASCII

2. Character:
   Alphabet, Figures, Symbols, Special characters
   Alphabet, Figures, Symbols, Special characters

3. Receiving Speed:

   [CW Receiving] 25 -- 250 characters/ min. (Automatic track)
   [RTTY "] 45.45, 50, 56.88, 74.2, 100, 110, 200, 300 baud
   (Fine adjustment available)
   [ASCII "] same as RTTY

4. Input:

   [AF Input] Impedance 500 ohms
   [TTL Level Input] common to CW, RTTY, ASCII

5. AF Input Frequency:

   [CW] 830 Hz
   [RTTY] Mark: 1275 Hz (Low Tone), 2125 Hz (High Tone)]or rev.
   Shift: 170 Hz, 425 Hz, 850 Hz, and Fine Tuning
   [ASCII] same as RTTY

6. Display Output:

   [VHF Output Impedance] 75 ohms
   [Composite Video Signals Output Impedance] 75 ohms

7. Printer Interface:

   Centronics Parallel Compatible

8. Number of Characters and Pages to be Displayed:

   512 characters (32 characters x 16 lines) / page x 2
   (Total: 1024 characters)

9. Output for Oscilloscope:

   Output Impedance 200 kilo-ohms

10. AF Output:

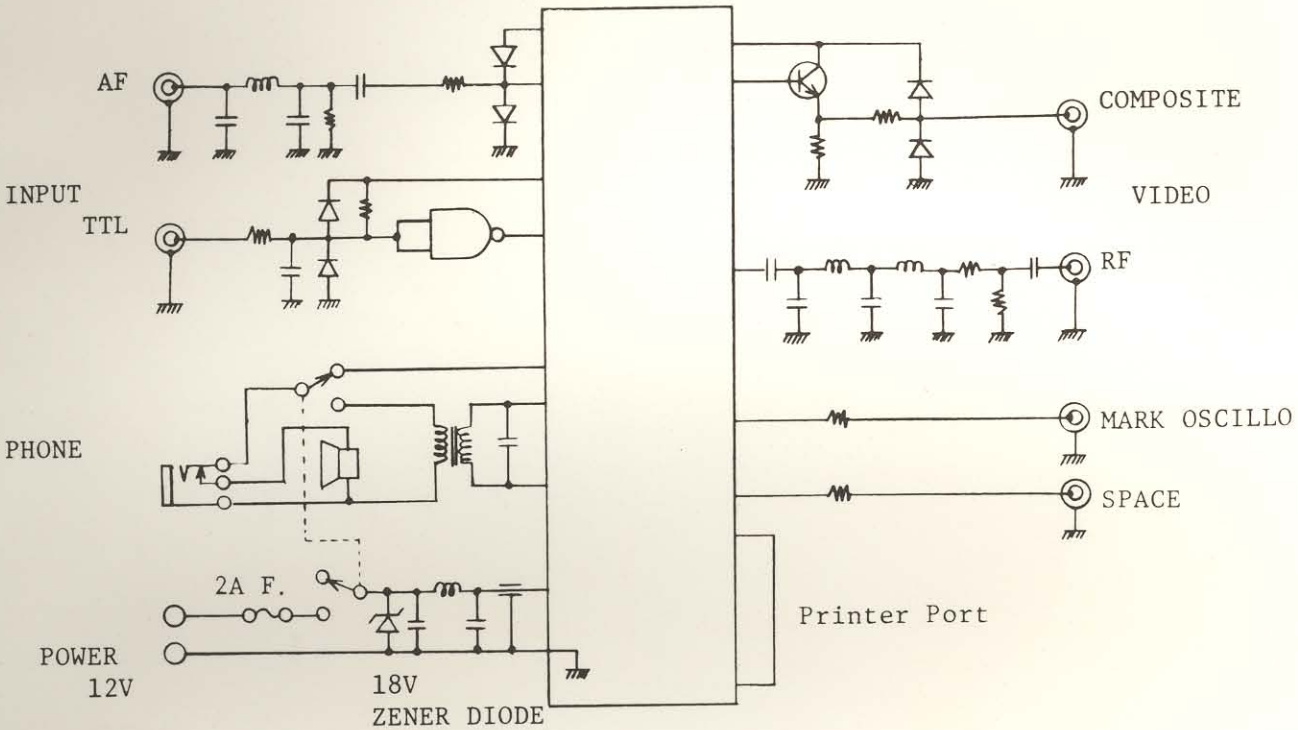
    150 mW, Output Impedance 8 ohms

11. Power Supply:

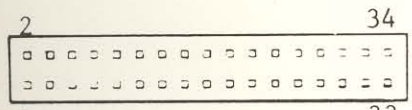
    DC +12 V, 0.8 A

NOTE: All of the features and specifications are subject to change without notice.

9. I/O CIRCUIT

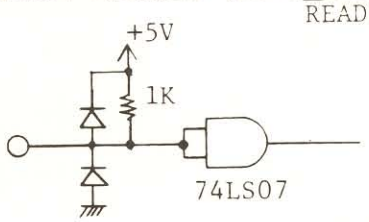


CN 6 PRINTER PORT

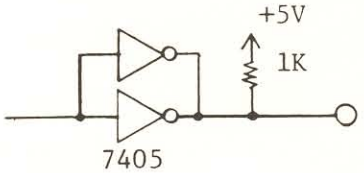


PIN		PIN	
1	$\overline{\text{DATA STROBE}}$	2	
3	DATA 0	4	
5	DATA 1	6	
7	DATA 2	8	
9	DATA 3	10	
11	DATA 4	12	GND
13	DATA 5	14	
15	DATA 6	16	
17	DATA 7	18	
19	$\overline{\text{ACKNOWLEDGE}}$	20	
21	$\overline{\text{READY}}$	22	
23	NC	24	
25	NC	26	NC
27	GND	28	NC
29	NC	30	GND
31	GND	32	NC
33	NC	34	NC

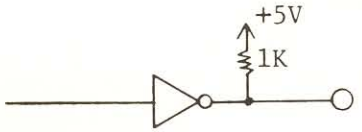
INPUT CIRCUIT ($\overline{\text{ACKNOWLEDGE}}$, $\overline{\text{READY}}$)



OUTPUT CIRCUIT ($\overline{\text{DATA STROBE}}$)



DATA 0 -DATA 7



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