Θ-777

INSTRUCTION MANUAL

TONO

PRECAUTIONS

1. Operate the unit with supply voltage DC 11-14V. Do not connect to an AC power source for commercial use.

2. The Theta-777 is designed against noises for communication use, however, some computers may generate large noises which interfere a transceiver.
   Please contact the manufacturer or the dealer of the computer in such cases.

3. Never open the upper case unnecessarily. Do not touch the parts or terminals inside.

4. It is suggested the unit be placed in a dry place, avoiding direct sun and dust.

5. Please refer to the instruction manual of the computer as well as of the Theta-777 to connect and operate them adequately.

6. When you use a Baudot terminal, press the "BLANK" key where "ESC" is indicated in this manual in order to output 'BLANK' code as the 'ESC' code is not available with the Baudot terminal.

NOTE: Certain keyboard commands require pressing two keys simultaneously. Such commands are denoted in this manual as, for example, "CTRL-X". Other commands require pressing two keys, one after other, but separately. Such commands are denoted as, for example, "ESC" "I".

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FEATURES OF THETA-777

The Theta-777 is the most advanced code converter of high performance designed with TONO's computer technology. The unit supports completely automatic send/receive of Morse Code (CW), Baudot Code (RTTY), ASCII Code (RTTY), JIS Code (RTTY), BIT INVERSION (RTTY) and new AMTOR (ARQ/FEC/SEL-FEC).

Interface

The built-in RS232C and TTL level interface enables you to use in combination with most of the computers or terminals. You can add features depending on the software of the computer.
(ASCII 100 - 200 bauds, Baudot 45.5 - 200 bauds)

Automatic Mode Selection Feature

The mode, speed and polarity of RTTY signal (Baudot, ASCII, JIS, Bit Inversion) can be automatically judged with the Theta-777.

Selcal (Selective Calling) System

With the feature the unit only receives messages following the preset code.

Wide Range of Transmitting and Receiving

Morse Code transmitting speed can be set from the keyboard at any rate between 5 - 100 WPM (every word per minute). AUTOTRACK on receive. For communication in Baudot and ASCII Codes, rate is variable by keyboard instruction between 12 - 200 bauds when using RTTY Modem and between 12 - 600 bauds when using TTL level.

Built-in Message Memory / Buffer Memory

Built-in Message Memory covering 64 characters x 4 channels, 32 characters x 7 channels and 16 characters x 4 channels, and a 768-character input buffer memory is available with the unit. Messages in the memory can be recalled from a keyboard instruction. You can write messages into any channels while receiving.

Full Automatic PTT Control

The send/receive switching of the PTT of a transceiver is done automatically with a computer control. Manual switching is also available.

CW Identification

In RTTY modes, keyboard-controlled CW identification is available if required.

Automatic Idle Signal Insertion

Idle signal (letters code) can be automatically inserted in a pause of transmission in Baudot-RTTY mode.

"ECHO" Function

With a keyboard instruction, received data can be read and sent out to the keying jacks or AFSK jack at the same time. This function enables a cassette tape recorder to be used as a back-up memory.

Automatic CR/LF

While transmitting, CR/LF is automatically sent every 64, 72 or 80 characters, as selected.

Pre-load Function

The buffer memory can store the messages written from the keyboard instead of sending them immediately. The stored messages can be sent with a keyboard command.

"RUB-OUT" Function

You can correct mistakes while writing messages in the buffer memory. Misspellings can also be erased while the information is still in the buffer memory.

CW Random Generator

Output of CW random signal can be used as CW reading practice.

Variable CW Weights

For CW transmission, weights (ratio of dot to dash) can be changed within the limits of 1:3 - 1:7.

Test Message Function

"RY" and "QBF" test messages can be repeated with this function.

Function Display System

Each function (mode, tone, shift, speed, etc.) is displayed on the screen.

CW Practice Function

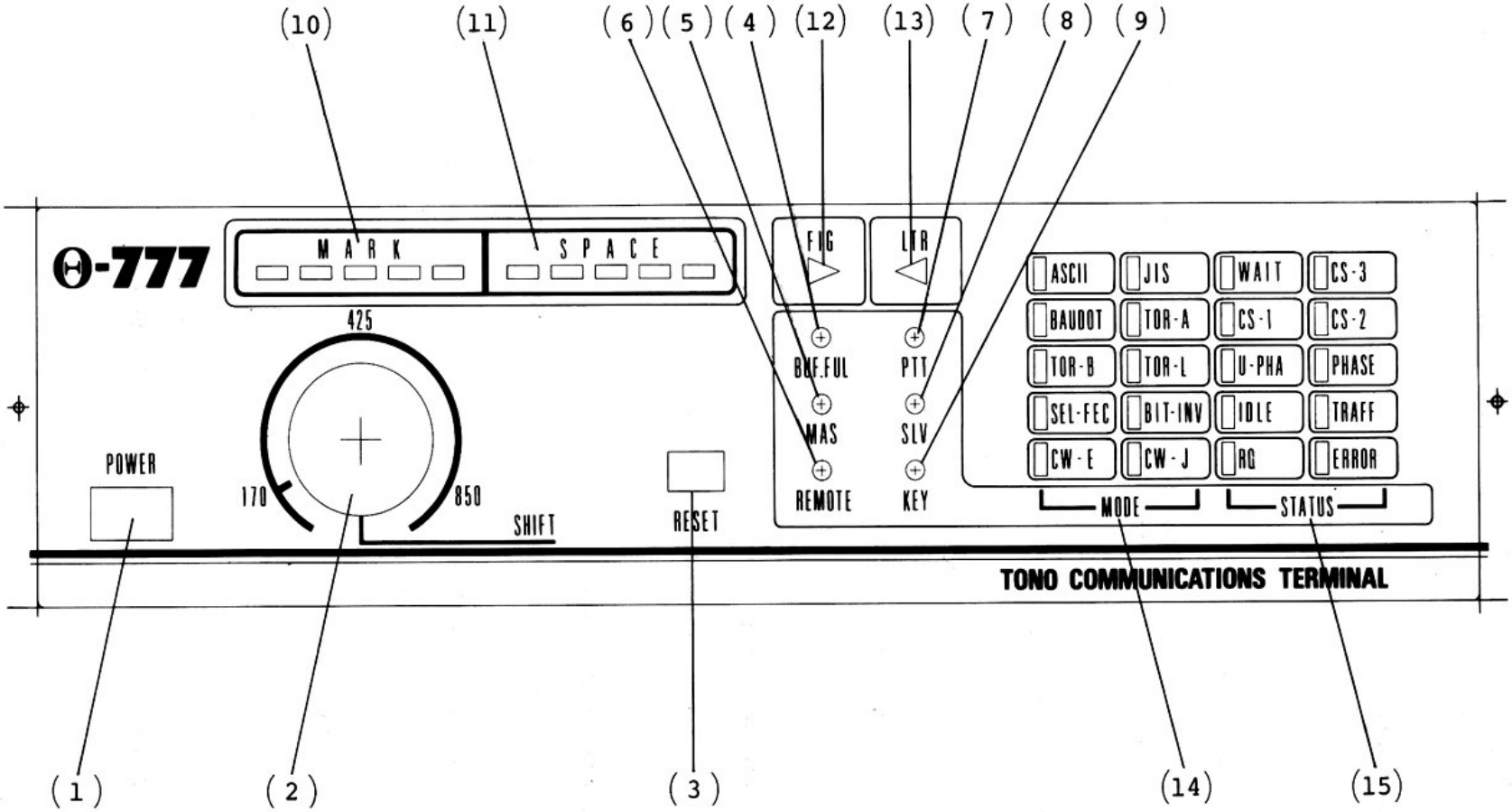
The unit reads data from the hand key and displays the characters on the screen. CW keying output circuit works according to the key operation by the "ECHO" function.

Mark-and-Break (Space-and-Break) System

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

Crystal Controlled AFSK Modulator

A transceiver without FSK function can transmit RTTY mode by utilizing the high stability crystal-controlled modulator controlled by the computer.



1. INSTALLATION

1.1 Front Panel Controls and Indicator

This section will assist you in becoming familiar with the switches and indicators on the front panel.

(1) POWER switch: controls all power to the unit.

(2) SHIFT volume: adjusts shift width within the range of 170Hz to 850Hz for RTTY modes.

NOTE: The figures printed around the volume such as '425' or '850' will give you a guidance on the rough tuning position.

(3) RESET switch: initializes the unit.

(4) BUF.FUL LED*: inidcates that the buffer is filled with messages.

(5) MAS LED: illuminates when your station is MS (Master Station);

red: when your station is ISS (Information Sending Station) in mode A or on transmitting side in mode B.

green: when your station is IRS (Information Receiving Station) in mode A.

(6) REMOTE LED: indicates that the REMOTE jack is on.

(7) PTT LED: indicates that the PTT jack is on.

(8) SLV LED: illumiates when your station is SS (Slave Station);

red: when your station is ISS.

green: when your station is IRS in mode A or on receiving side in mode B.

(9) KEY LED: indicates that the keying jack is on.

(10) MARK LED: indicates tuning of mark filter.

(11) SPACE LED: indicates tuning of space filter.

(12) FIG LED: indicates that FIGURE case is selected in the Bit Inversion, Baudot and AMTOR modes or that Japanese Morse Code is selected in the CW mode.

(13) LTR LED: indicates that LETTER case is selected in the Bit Inversion, Baudot and AMTOR modes or that Continental Morse Code is selected in the CW mode.

(14) MODE LED's: indicates the selected mode respectively.

(15) STATUS LED's: indicates the status in the AMTOR modes respectively.

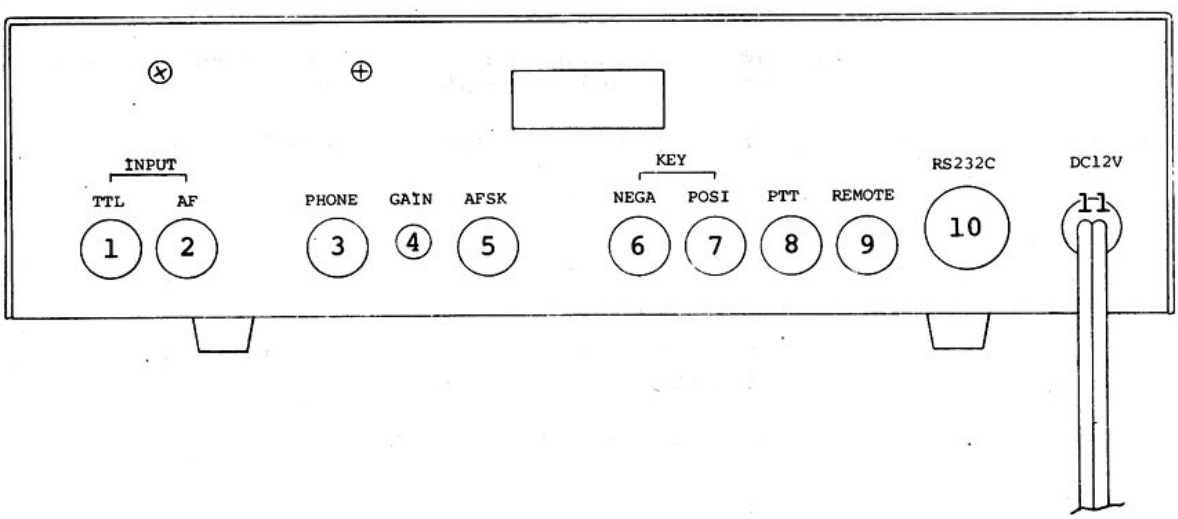
***NOTE:** The data sent from the terminal is stored in the input buffer of the Theta-777. The BUF.FUL LED illuminates to inform that the input buffer is full of data due to the transmission speed lower than the typing speed. Therefore please understand that the data will not be accepted and fall out from the buffer when

1) the connection of a terminal and the Theta-777 is half duplex
2) the data is exceeding the maximum 768 characters in pre-loaded buffer status

In above cases, care should be taken not to type in data exceeding the maximum capacity of the input buffer.

1.2 Rear Apron Connections

This section will introduce you into the rear apron connections on the unit.



(1) INPUT TTL jack: This is an input accepting TTL levels for connection of an external terminal unit or key driving the input of the Theta-777.

(2) INPUT AF jack: This is an audio input from a transceiver, tape recorder, etc.

(3) PHONE jack: to defeat internal speaker and use external speaker or headphones.

(4) GAIN control: adjusts the output level of the AFSK jack.

(5) AFSK jack: This is an audio output from the AFSK generator and may be used to feed a transceiver or tape recorder.

(6) KEY NEGA jack: connected to a keying circuit whose polarity is plus (+) grounded. Common to CW and RTTY.

(7) KEY POSI jack: connected to a keying circuit whose polarity is minus (-) grounded. Most of current transceivers are connected to this jack. It is necessary to replace the connection cord when you change the operating mode between CW and FSK according to each mode.

(8) PTT jack: This jack controls the PTT (Push-to-talk) line of the transceiver if desired. It switches on when the unit is in the transmit mode.

(9) REMOTE jack: This is a keying output for use with accessory equipment.

(10) RS232C jack: connected to an ASCII terminal, a Baudot terminal or a computer. The output of the Theta-777 is RS232C compatible output or TTL level output. The input can be selected by cutting a part of the pattern on the PC board.

(11) DC12V jack: for a DC power source. DC power requirement is 11 - 14V, 1A. Connect plus (+) to red, minus (-) to black.

1.3 Screen Indications (Status Lines)

```
MODE=BAUDOT
TONE=LO N
SENSE:RX=N.TX=N
INPUT=AF
SPEED=45.5BPS
FUNC=
PTT=MANU

HC=???? GC=???? DLY=19MS
```

MODE=BAUDOT — indicates which communication mode is selected;

indication	mode	key commands
ASCII	ASCII	"ESC" "M" "1"
JIS-8	JIS	"ESC" "M" "2"
BAUDOT	Baudot	"ESC" "M" "3"
AMTOR	ARQ (AMTOR mode A) FEC (AMTOR mode B) SEL-FEC (Selective mode B)	"ESC" "M" "4"
TOR-L	TOR-Listen (AMTOR mode L)	"ESC" "M" "5"
BITINV	Bit Inversion	"ESC" "M" "6"
MORSE	Continental Morse	"ESC" "M" "7"
JMORSE	Japanese Morse	"ESC" "M" "8"

TONE=LO N — indicates tone and shift width selected. (In Morse modes, HI for signals of over 50 WPM, LO for under 50 WPM.)

HI ..... High Tone (Mark Frequency 2125Hz)
LO ..... Low Tone (Mark Frequency 1275Hz)
N ..... Shift Width 170Hz
M ..... Shift Width 425Hz
W ..... Shift Width 850Hz

SENSE:RX=N.TX=N — indicates the polarity of send/receive. N is for Normal, and R for Reverse.
The keystroke "ESC" "O" "1" reverses the polarity of the receiving. (The same keystroke cancels it.)
The keystroke "ESC" "O" "2" reverses the polarity of the transmitting. (The same keystroke cancels it.)

INPUT=AF

indicates which input jack is selected. Press "ESC" and "4", "5" or "6".

Number	Indication	
4	TTL	TTL level input
5	AF	AF input
6	ANTI	AF input (Anti-noise circuit is activated.)

SPEED=45.5BPS

indicates communication speed selected.

in Morse	by WPM
in other modes than Morse	by BPS (=bauds)

FUNC=

indicates other function in use.

		key commands
E:	Echo Back function	"ESC" "E"
P:	Pre-load function	"ESC" "P"
S:	Selcal function	"ESC" "C"
U:	Unshift-on-Space function	"ESC" "K" "3"
W:	WRU (Who are you) function	"ESC" "4"

PTT=MANU

indicates switching method for the on/off of PTT, manual or automatic.
The keystroke "ESC" "K" "1" enables automatic on/off of the PTT jack. Press "ESC" "P" or "TAB" to return to manual PTT line keying.

HC=???? GC=???? DLY=19MS (Not applicable in modes other than AMTOR.)

HC= indicates four alphabets for the selcal of your own station used in ARQ mode.

GC= indicates four alphabets for the selcal of your own station used in SEL-FEC mode.

DLY= indicates the delay time in ARQ mode. Set at 19MS initially.

2.1 Connections with Peripheral Equipments

Make sure that each equipment works properly with its power-on status before making any connections.

Power Supply

The power switch of the Theta-777 should be OFF before the power supply cord is connected. DC power source to be used with the unit should be of 12VDC with minimum ripple. Red to plus (+), black to minus (-).

Terminal Unit

The outputs of the Theta-777 are RS232C compatible output and TTL level output. The input can be selected by cutting a part of the pattern on the PC board. The FAN OUT of TTL level output is three standard-TTL. Be sure to avoid over-load.

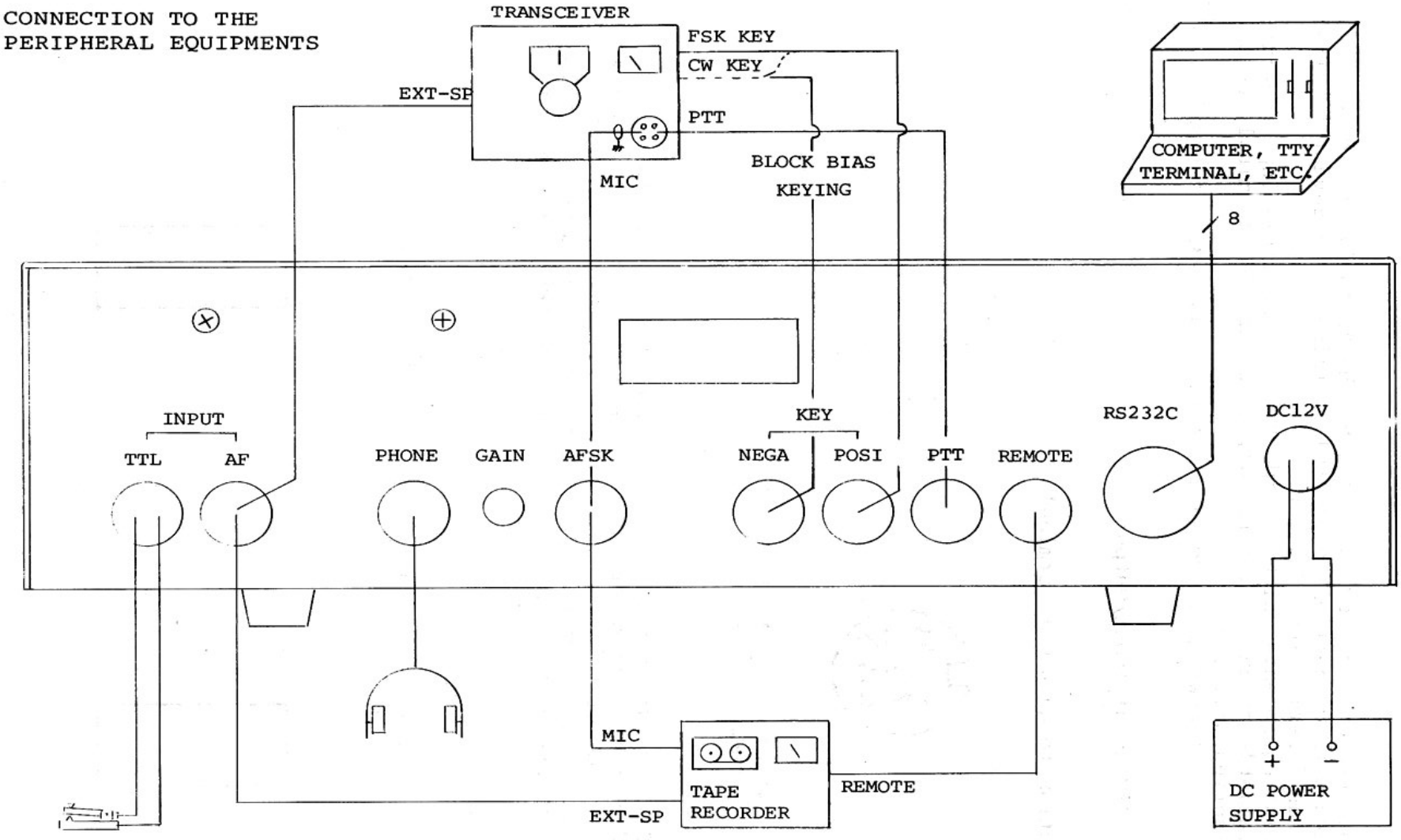
Oscilloscope

An oscilloscope may be used for cross-hatch tuning aid. Carefully remove the upper case of the Theta-777, and connect an oscilloscop to J9 and J10 on the PC board. These terminals have an output impedance of 200K ohms, 1.5Vp-p. An oscilloscope of more than 1-M ohm input impedance may be used with the unit.

Transceiver

The Theta-777 can be connected to most of the transceivers. For the operation of FSK or CW, connect the KEY JACK of the Theta-777 with the KEY JACK of a transceiver. Connect the external PTT jack on the rear panel of the Theta-777, then the send/receive switchin of the transceiver can be controlled totally from the keyboard. Connect the AF output of the transceiver such as the external speaker jack to the INPUT AF jack of the Theta-777 in every mode. When the FSK function of the transceiver is not used or when using the key jack for CW keying, connect the MIC terminal inside of the MIC jack of the transceiver to AFSK jack of the Theta-777.

CONNECTION TO THE PERIPHERAL EQUIPMENTS

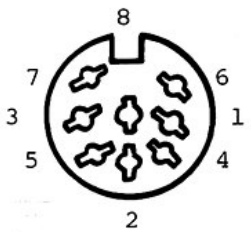


2.2 Connections with a Terminal

As mentioned in the previous section, the Theta-777 is to be operated with connection to an ASCII terminal or a Baudot terminal which has a serial input/output.
Following equipments which provide RS232C compatible input/output are available as an ASCII terminal; computer, CRT terminal, usual Theta-series units, etc.
A radio teletypewriter, etc. are available as a Baudot terminal.

1) RS232C Level Input/Output

Connection to an ASCII terminal



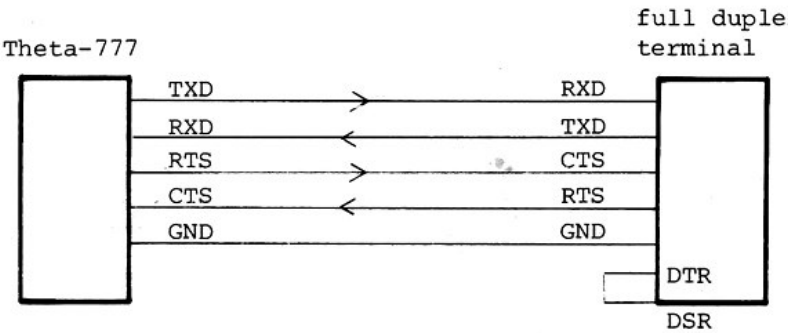
VIEW FROM THE SIDE WHICH
A CABLE IS SOLDERED

1.	TTL RTS	
2.	TTL TXD	
3.	+5V	
4.	CTS	4 RTS
5.	RXD	2 TxD
6.	RTS	5 CTS
7.	TXD	3 RxD
8.	GND	7 GND

The RS232C socket for the computer side of the cable is not included in the accessories, so please prepare a socket suitable for your computer.
Refer to the instruction manual of the computer as well as this manual to avoid any problems caused by mistakes in connections.

Full Duplex

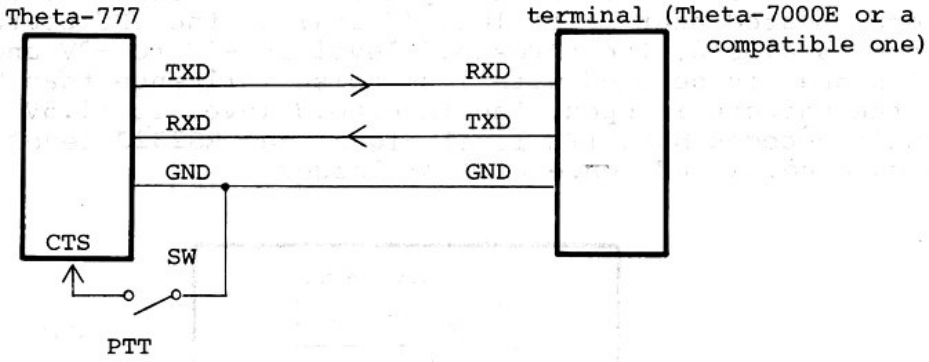
Use full duplex mode if available with the terminal.



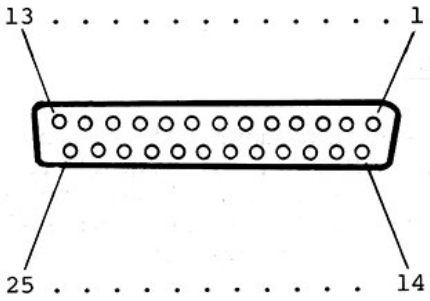
DTR and DSR on the terminal side should be shorted.

Half Duplex

In order to avoid data falling out, install a switch to the CTS line and set the input of the Theta-777 on TTL level.
Note that data may fall out on the terminal side when RS232C level input is selected.



RS232C Pin Arrangement



VIEW FROM THE SIDE WHICH SOLDERING SHOULD BE MADE

See the above figure for the pin arrangement of the standard RS232C socket of a computer. Refer to the description on RS232C interface in the manual of each computer.

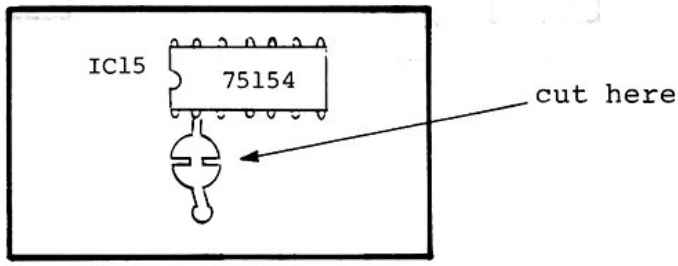
Generally the D-SUB (DB-25) connector of 25-pin is used to connect with RS232C interface of a computer.

1.	FG	ground of the body -to GND of the Theta-777
2.	TXD	TX signal line
3.	RXD	RX signal line
4.	RTS	sends request for transmission
5.	CTS	checks if the companion unit can receive signal
6.	DSR	checks if the companion unit is working
7.	SG	ground of the signal line -to GND of the Theta-777
8.	DCD	
9.	NC	
10.	NC	
11.	GND	
12.	NC	
13.	GND	
14.	GND	
15.	TXC(2)	
16.	NC	
17.	RXC	
18.	NC	
19.	NC	
20.	DTR	informs of the unit to be working to the companion unit
21.	NC	
22.	NC	
23.		
24.	TXC(1)	
25.	NC	

2) TTL Level Input/Output

The input/output of some terminals is on TTL level. And when a terminal is operated by half duplex, set the input of the Theta-777 on TTL level.

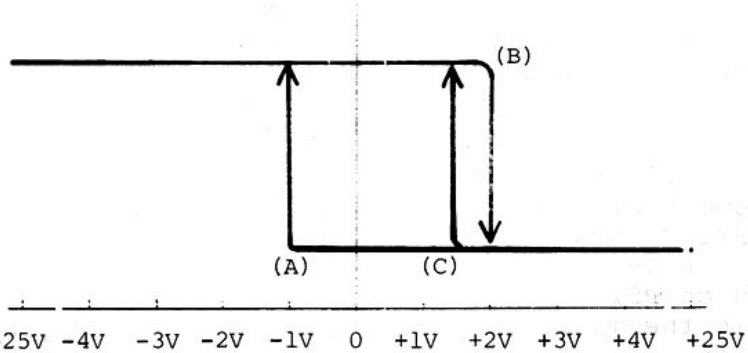
In order to select TTL level input for the Theta-777, cut the pattern located near 2P of IC15 (75154) on the CPU board. When the pattern is closed, the threshold level is -1V to +2V and the RS232C level signal is decoded with less noise influence than TTL level. When the pattern is open, the threshold level is +1.5V to 2V and the unit decodes both TTL level signal and RS232C level signal. In this case noise influence will be larger.



The output line should be connected to TTL RTS and TTL TXD instead of RTS and TXC respectively.

Threshold Level according to Pattern Cut

The threshold level is a boundary to make judgement of a signal whether at H level (Space) or at L level (Mark). A signal is changed its level from H level to L level or from L level to H level when exceeds the boundary. When the voltage of a signal stays within the boundary, the signal remains to be at the same level as it was.



The threshold level after cutting pattern is shown by a boundary surrounded by line (B) and (C).

The threshold level before cutting pattern is shown by a boundary surrounded by line (A) and (B).

It is necessary to cut the pattern when TTL level input is selected in order to change the threshold level for the judgement of H/L level (Mark/Space) of a signal.

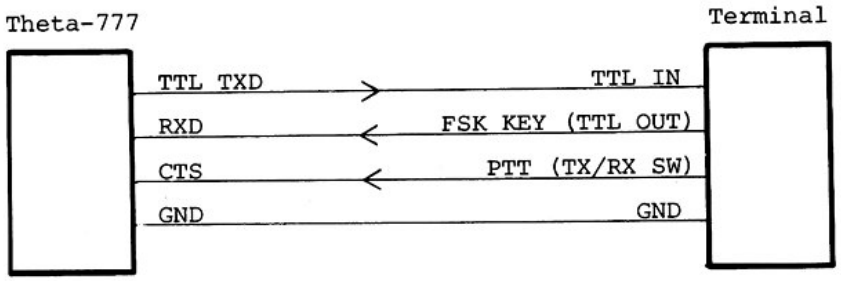
Before cutting the pattern, the threshold level is around -1V - +2V so a TTL level signal of +5V - 0V cannot exceed the lower line of the boundary.
On the other hand, an RS232C level signal of +12V - -12V exceeds the lower/upper line of the boundary so that the judgement of H/L level of a signal can be made.

After cutting the pattern, the threshold level becomes +1.5V - +2V, and both of RS232C level signal and TTL level signal can be judged whether at H level or L level.

Connection to a Baudot Terminal

Make connection using the accessory DIN plug as in the figures below. Prepare a plug for the terminal side according to each unit. Refer to the figure in the 'Connection to an ASCII terminal' section and the figures below for the wiring of the DIN plug.

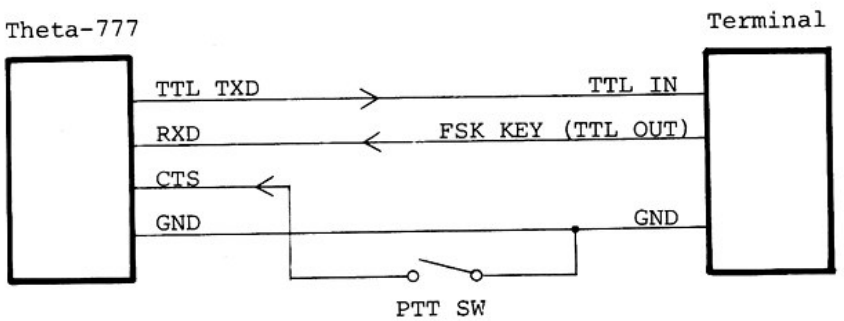
Terminal with PTT switch



NOTE: Refer to 'TTL level input' in 'Connection to an ASCII terminal' section as the input should be set on TTL level.
Cut the pattern around pin no.2 of IC15.

Terminal without PTT switch

If PTT (TX/RX SW) is not available, install an external one.



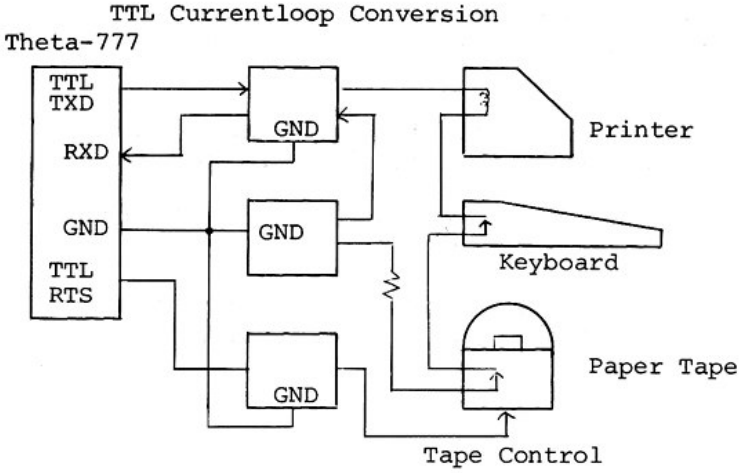
NOTE: When the checking of PTT is not necessary, leave CTS line disconnected.
Without the switch, the terminal cannot receive data while transmitting so the data will fall out while in this state. (The Theta-777 continues transmission.)

In either of two cases, turn the dip switch no.7 to OFF (activates echo-back).
In echo-back state, data returns to the terminal when the PTT switch is turned off (open).
When the PTT switch is on (closed), the output from the Theta-777 to the terminal (TTL TXD) is interrupted.

```
**********************************************************
*                                                        *
*  When you use a Baudot terminal, press the "BLANK"     *
*  key where "ESC" is indicated in order to output       *
*  'BLANK' code as the 'ESC' code is not available       *
*  with the Baudot terminal.                             *
*                                                        *
**********************************************************
```

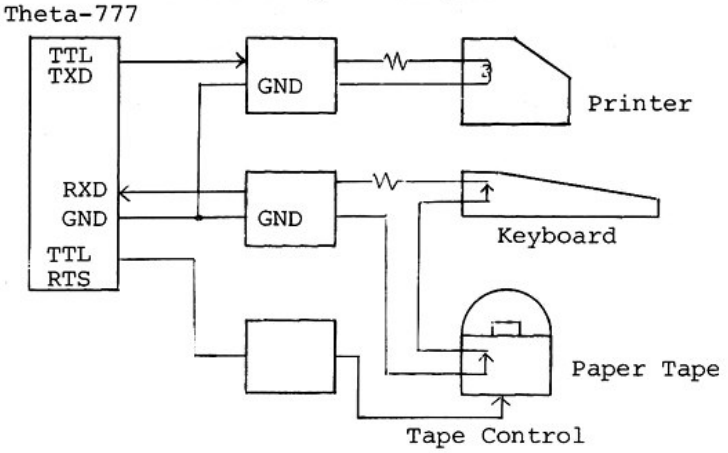
Connect a Baudot terminal as in the figures below.
For simultaneous send/receive between the terminal and the Theta-777, connect as shown in lower figure.

TTL Currentloop Conversion



Turn the dip switch no.7 ON (deactivates echo-back)

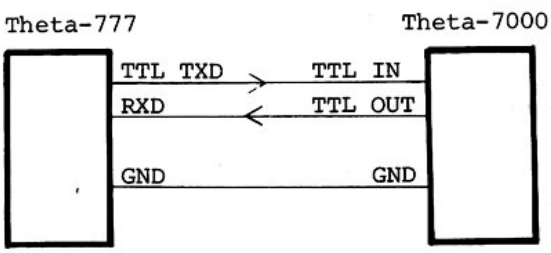
TTL Currentloop Conversion



Turn the dip switch no.7 OFF (activates echo-back)

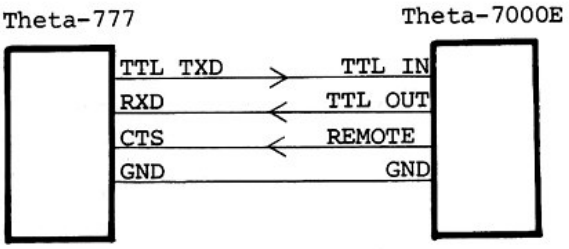
3) Connection to the Theta-series units

The Theta-7000 and the Theta-7000E should be used as ASCII terminal. Make connections as in the figures below;



Dip Switch
No. 7 - off (ECHO ON)
No. 8 - on (HALF DUP)

DISPLAY=RX



Dip Switch
No. 7 - on (ECHO OFF)
No. 8 - off (FUL DUP)

PTT=AUTO

Communication mode should be ASCII. Set the dip switches of the Theta-777 according to the terminal. (The switch no. 7 should be set to off.) Cut the pattern near IC15.

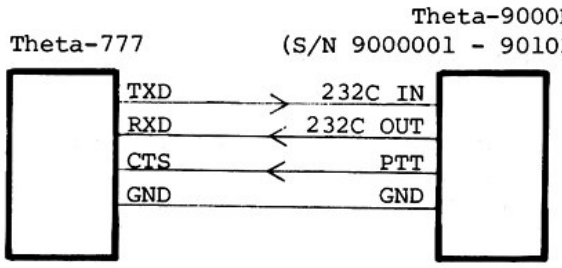
These connections are for half duplex mode. Note that operation of Japanese Morse and JIS modes are not available using the Theta-7000 or the Theta-7000E.

In case of using the Theta-7000, it would be convenient for operation if the display switch of the Theta-7000 is set to RCV.

In case of using the Theta-7000E, it is suggested to set the unit in automatic PTT switching status.

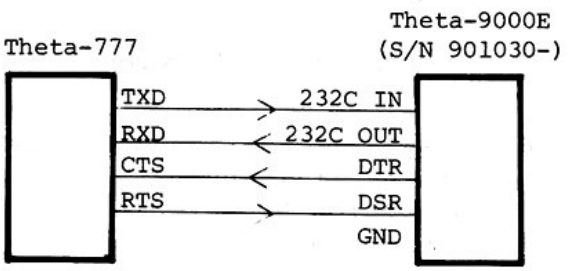
As the "TAB" key is not equipped with the Theta-7000 or the Theta-7000E, press "ESC-D" instead of "TAB" for ending transmission in AMTOR modes and so on.

The Theta-9000E can be used as a Baudot terminal or an ASCII terminal, however, it is suggested to be used as an ASCII terminal. The full duplex mode is available with the Theta-9000E of serial number greater than 901030 like the RS232C full duplex communication with the computers.
Connections should be made as in the following figures according to the serial number of each unit.



Dip Switch
No. 7 - on (ECHO OFF)
No. 8 - off (FUL DUP)

INPUT=232



Dip Switch
No. 7 - off (ECHO ON)
No. 8 - off (FUL DUP)

INPUT=232
FUNC=FUL

'ESC' (escape) code output

The 'ESC' code is transmitted from the Theta-series units with the following key commands.

Theta-9000E (S/N 900001 - 901029)	"ESC" or "CTRL-1" or "CTRL-["
Theta-9000E (S/N 901030-up)	"CTRL-ESC" or "CTRL-["
Theta-7000E	"ESC"

4) Communication between a Computer and the Theta-777

In order to connect the Theta-777 to a computer with RS232C serial interface, it is necessary to set the both unit at the same communication speed. The Theta-777 can operate at 100 - 2400 bauds. Set the speed according to the specifications of the computer.

Each parameter is to be set as follows;

parity bit = none
bit construction = 8 data bits > or < 7 data bits
stop bit = 1 bit > or < 2 stop bits
communication mode = full duplex or half duplex
(full duplex is recommended)

There are two ways to send/receive between the two units; one is to operate the computer as a terminal, the other is to control it by software.

Set the communication speed, parity bit, bit contruction, stop bit and communication mode as explained above prior to the operation.

To operate the computer as a terminal, set the computer in terminal mode by inputting commands as the following examples.

example

	model	command
NEC	PC9801 PC8801	TERM"COM:N81",F
FUJITSU	FM-7 FM-8	TERM"S8N1FN"

To activate the communication between the computer and the Theta-777 controlled by software, input the program as follows according to the computer.

An example of program for controlling NEC PC9801 and PC8801 by software

```
 10  ON COM GOSUB 80 ..............  starting address for interruption
 20  OPEN "COM:N81" AS #1 ........  opens the communication file for
 30  COM ON                         RS232C (no parity bits, 8 data bits,
                                    1 stop bit)
 40  A$=INKEY$          ]
 50  IF A$="" THEN 40   ]   ........  reads key instructions
 60  GOSUB 120
 70  GOTO 40
 80  IF EOF(1) THEN RETURN  ]
 90  B$=INPUT$ (LOC(1), #1) |
100  PRINT B$;              |  ....  reception interrupting routine
110  RETURN                 ]
120  PRINT #1, A$;  ..............  for transmission
130  RETURN
```

A sample program for the APPLE II is on page 58.

5) Setting of the Dip Switches

Before starting operation, set the dip switches on the PC board of the Theta-777 in order to send/receive between either an ASCII terminal or a Baudot terminal and the Theta-777.

	ON	OFF	
SW 1	TXD NOR	TXD REV	Switches the polarity of TXD.
SW 2	RXD NOR	RXD REV	Switches the polarity of RXD.
SW 3 SW 4 SW 5	for setting communication speed - refer to the table below.		Selects the communication speed by the combination of switches 3, 4 and 5.
SW 6	BAUDOT	ASCII	Selects the code.
SW 7	ECHO OFF	ECHO ON	Activates/disactivates the Echo-back function.
SW 8	HALF DUP	FUL DUP	Selects the mode.

NOTE: The underlined are the factory settings.

Baudot	ASCII	SW 5	SW 4	SW 3
45.45B	100B	OFF	OFF	OFF
50 B	110B	OFF	OFF	ON
56.88B	150B	OFF	ON	OFF
74.2 B	200B	OFF	ON	ON
100 B	300B	ON	OFF	OFF
110 B	600B	ON	OFF	ON
150 B	1200B	ON	ON	OFF
200 B	2400B	ON	ON	ON

NOTE: The underlined are the factory settings.

6) Confirmation of Settings

Confirm your connections and settings by the following procedure.

a. Press "ESC" "?".

Are the initial screen indications as in page 7 displayed?

YES → The connections and the settings are correct. The input/output of each unit is communicated correctly.

NO ↓

b. Press "RESET" key.

Are the initial screen indications as in page 7 displayed?

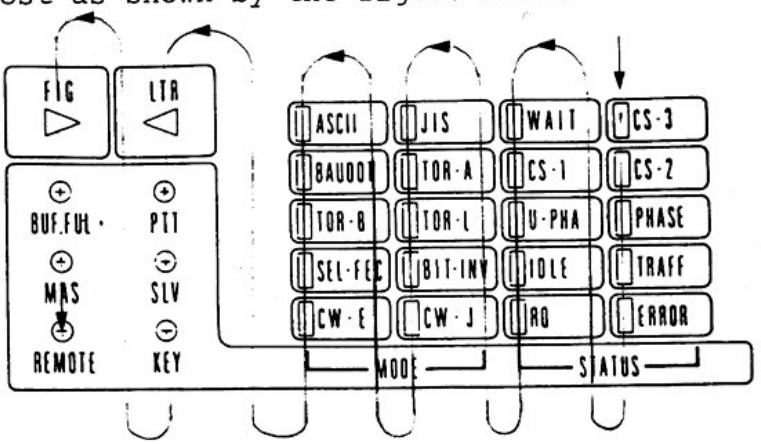
YES → The output from the Theta-777 to the terminal is correct.

NO → Check the connection from the terminal to the Theta-777.

The connection of both of the input and/or output may be incorrect.

Check again the procedure of the connections and the settings.

When the setting of SW 2 of the dip switches is not corresponding to the incoming signal (which means that the setting on polarity is incorrect), LEDs on the front panel illuminate in order from the top to the bottom of the five right-most LEDs to the left-most as shown by the figure below.



c. If random characters or figures are displayed, the communication speed or the polarity may not be agreed.

Set the dip switches of the Theta-777 according to the specifications of the terminal.

When you use a Baudot terminal, press the "BLANK" key where "ESC" is indicated in order to output 'BLANK' code as the 'ESC' code is not available with the Baudot terminal.

3.1 CW (Continental Morse) Mode

To select the Continental CW mode, press "ESC" "M" "7" one after another.

Receiving

Practice tuning using VFO (RIT) of the transceiver to the point where the maximum amplitude of the mark LED is achieved. The Theta-777 automatically tracks the speed and starts decoding when properly tuned. Set the unit at high tone by the keystrokes "ESC" "T" and "4", "5" or "6" for AUTOTRACK of higher speeds (above 50 WPM). For lower speeds, the unit should be set at low tone by the keystrokes "ESC" "T" and "1", "2" or "3". Usually the unit may be operated at lower speeds with the setting for low tone. In case signals of lower speeds are received with the setting for high tone the unit tracks the signal, however, may become weak against noises.

Anti-noise Feature

Press "ESC" "K" "6" if noise causes unwanted random-character reception with no existing signals.

Input Selection

To select TTL IN terminal for an electric keyer or other TTL level input, press "ESC" "K" "4". The keystrokes "ESC" "K" "5" select AF IN terminal for audio signal input from a transceiver, tape recorder, or other audio device.

Automatic/Manual P.T.T. (push-to-talk) line keying

Press "ESC" "K" "1" to select automatic P.T.T. line keying. The P.T.T. line is keyed whenever there are characters to transmit. "ESC" "D" or "TAB" unkeys the P.T.T. line.
Another keystroke of "ESC" "K" "1" returns the unit to manual P.T.T. operation. The P.T.T. line is keyed/unkeyed by the keyboard instruction "ESC" "D" or "TAB".

Weight Setting (Dot to Dash Ratio)

Weight is adjustable in the range of 1:3 - 1:7. Press "ESC" "W" followed by the keystroke of the desired number (Ø through 9).

Speed Setting

On receiving the Theta-777 autotracks in the range of 5 - 100 WPM (word/minute).
On transmitting the speed is set by number of word per minute. Any speed down to one decimal place can be entered in the range of 5 - 100 WPM.

eg. 9 WPM = "ESC" + "S" + "9" + "." + "Ø"
63.5 WPM = "ESC" + "S" + "6" + "3" + "." + "5"
100 WPM = "ESC" + "S" + "1" + "Ø" + "Ø"

NOTE: 100 WPM is the maximum CW speed that the Theta-777 can offer. Any possible screen indication of over 100 WPM does not indicate an actual speed in use.

Your desired communication speed is programmed by "ESC" "S" "R" which should be pressed after setting the speed as explained above.

Special Characters

Upon any of the following special characters the Theta-777 sends CR/LF information to the connected computer.

Special Characters	Screen Display
$\overline{KN}$	(
$\overline{AR}$	+
$\overline{VA}$	*

3.2 CW (Japanese Morse) Mode

The keystroke "ESC" "M" "8" selects the Japanese CW mode which is initially set to print English characters.

To select Japanese kana characters for the contact, press "ESC" "1" to transmit ホレ. Japanese kana characters are also selected on reception of ホレ code.

The output of $\overline{BT}$ by pressing "ESC" "2" or receiving $\overline{BT}$ code returns the unit to print English characters.

When receiving, the keyboard instruction "ESC" "X" enables manual switching of the English/kana characters.

Judging of $\overline{BT}$ and ﾒ

When '-...-' code is received in Japanese CW mode, the unit cannot judge which signal of $\overline{BT}$ or ﾒ is sent since both two signals correspond to the code.

With the keystroke "ESC" "K" "3", the unit judges the code to be ﾒ and locks in printing Japanese kana characters. The indication on the screen will be FUNC=U. So give the instruction previously in order to keep your contact in Japanese kana characters. With another keystroke of "ESC" "K" "3", the unit judges the code to be $\overline{BT}$ and changes to print English characters. The indication will be just FUNC=.

3.3 Baudot Mode

Connection should be made between the RTTY or FSK terminal of the transceiver and FSK jack of the Theta-777. In the absence of RTTY or FSK modes, use LSB (AFSK) and connect microphone terminal to the AFSK jack of the Theta-777.

Press "ESC" "M" "3" to initialize the Baudot mode.

Mark/Space Tone and Shift Width

The keystroke "ESC" "T" and a number "1" through "6" selects shift width and tones.

Number	Indication	Mark Freq.	Space Freq.	Tone, Shift Width
1	TONE=LO N	1275 Hz	1445 Hz	Low Tone, 170 Hz
2	TONE=LO M	1275 Hz	1700 Hz	Low Tone, 425 Hz
3	TONE=LO W	1275 Hz	2125 Hz	Low Tone, 850 Hz
4	TONE=HI N	2125 Hz	2295 Hz	High Tone, 170 Hz
5	TONE=HI M	2125 Hz	2550 Hz	High Tone, 425 Hz
6	TONE=HI W	2125 Hz	2975 Hz	High Tone, 850 Hz

Reverse/Normalize the Polarity of TX/RX Signals

Polarity of TX/RX signals is switchable by the keyboard instruction.

Transmission	Press "ESC" "O" "2"	*1
Reception	Press "ESC" "O" "1"	

Input Jack Selection

Press "ESC" "K" "4", "5" or "6" to select input jack.

Number	Indication	
4	TTL	TTL level input
5	AF	AF input
6	ANTI	AF input (Anti-noise circuit is activated)

Automatic/Manual PTT (push-to-talk) line keying

Press "ESC" "K" "1" to select automatic PTT line keying. The PTT line is keyed whenever there are characters to transmit. "ESC" "D" or "TAB" unkeys the PTT line.
Another keystroke of "ESC" "K" "1" returns the unit to manual PTT operation. The PTT line is keyed/unkeyed by the keyboard instruction "ESC" "D" or "TAB".

Character Setting

The alternate "letters" or "figures" character set is selectable by the keystroke "ESC" "X".

Automatic CR/LF Insertion

CR/LF is automatically inserted by the keyboard instruction.

no automatic CR/LF insertion	Press "ESC" "L" "Ø"	
64 characters after last CR/LF	Press "ESC" "L" "1"	
72 characters after last CR/LF	Press "ESC" "L" "2"	*2
80 characters after last CR/LF	Press "ESC" "L" "3"	

Speed Setting

Speed may be set as desired in the range of 12-600 bauds. 45.5, 50, 56.9, 74.2, 100, 110, 150, 300 and 600 bauds are most commonly used. Among those rates, 45.5 bauds is most commonly used in amateur bands, and 50 bauds is common in commercial use. Three significant figures including decimal place may be entered, such as:

100 bauds = "ESC" + "S" + "1" + "Ø" + "Ø"

45.5 bauds = "ESC" + "S" + "4" + "5" + "." + "5"

50 bauds = "ESC" + "S" + "5" + "Ø" + "." + "Ø" *3

Your desired communication speed is programmed by "ESC" "S" "R" which should be pressed after setting the speed as explained above.

Diddle Feature

The "LETTERS" shift character will be transmitted while the keyboard is idle in order to keep the receiver in synchronization or to keep the threshold level of the ATC circuit in the demodulator at a fixed level. Press "ESC" "/" to activate the function.

Unshift-on-Space (U.S.O.S.)

This function causes the unit to return to the "LETTERS" mode upon receipt of a space character. It is very useful when noise causes case errors.
The feature turns by the keystroke "ESC" "K" "3". On the screen FUNC=U is displayed.

CW ID

The keystroke "ESC" "I" transmits CW identification. The identification code should be previously written in Channel #E.

The transmitting speed will be as programmed in the CW mode by the keystrokes "ESC" "S" "R".

*1 **NOTE:** Some transceivers have different polarity setting of FSK TX signals than others.

Examples:

DRAKE, TRIO-KENWOOD transceivers: reverse polarity

ICOM, YAESU transceivers: normalize polarity

*2 **NOTE:** The initial setting; when power is turned on or the RESET key is pressed.

*3 **NOTE:** "Ø" must be entered after the decimal point when a two-figure speed is selected.

Receiving Operation

1. Place your transceiver in the RTTY mode (for most transceivers, this is LSB).
2. Practice tuning using VFO (RIT) of the transceiver from lower level to the second point where the mark LED illuminates.
3. Tune using SHIFT control to the point where the maximum amplitude of the space LED is achieved.
4. If a meaningful screen display is not achieved when both mark and space LEDs illuminate, try changing the polarity. If this does not work, speed adjustment is needed. Any signals that cannot be received successfully with any speed/polarity are probably encoded.

3.4 ASCII (RTTY) Mode

Press "ESC" "M" "1" to initialize the ASCII mode.
Operational procedures and functions are the same as in Baudot mode.

3.5 JIS (RTTY) Mode

Press "ESC" "M" "2" to initialize the RTTY (JIS) mode.
Operational procedures and functions are the same as in Baudot mode.

In the JIS mode, alphabet/kana characters are printed according to the input from the computer.

3.6 Bit Inversion Mode

Press "ESC" "M" "6" to select the Bit Inversion mode. This mode is a term of communication in cipher based on Baudot code and should not be used among amateurs.

The signals are ciphered by reversing the polarity of bit/bits of five-bit-Baudot code voluntarily. The data of contact can be kept from anybody except who is agreed on the combination of inversion in advance.

The combination of inversion is specified by the keyboard instruction "ESC" "G" and a five-number-combination made up of 0 and/or 1. The keystroke "1" reverses the polarity of the bit and "0" leaves it as in normal polarity. Each number corresponds to bit 4-0 from the first number to the last. The five right-most LEDs of twenty mode/status LEDs indicate which bit/bits are reversed by illuminating where "1" is entered. Each LED signifies bit 4-0 from the top respectively.
Both your station and a distant station should set the agreed combination prior to a contact.

example To reverse the polarity of the bit 4 and bit 1, press

"ESC" + "G" + "1" + "0" + "0" + "1" + "0"

then the first and the forth LEDs from the top will illuminate.

The combination of '00000' represents the standard Baudot-RTTY, and the polarity of all bits are reversed when '11111' is keyed in.

Considering the five-number-combination as a numerical value in binary notation, you can increase the value by one with the keystroke "ESC" "G" "2". Therefore when no bit is reversed, first keystroke of "ESC" "G" "2" increases the value from '00000' to '00001' and the second one increases it to '00010'. The LED indication on the unit will change accordingly.

example When '10011', "ESC" "G" "2" increases it to '10100'.

When '01111', "ESC" "G" "2" increases it to '10000'.

Operational procedures and functions are the same as in Baudot mode.

```
**********************************************************
*                                                        *
*  When you use a Baudot terminal, press the "BLANK"     *
*  key where "ESC" is indicated in order to output       *
*  'BLANK' code as the 'ESC' code is not available       *
*  with the Baudot terminal.                             *
*                                                        *
**********************************************************
```

Preloaded Buffer Transmission

The Theta-777 has a 768-character input buffer memory.

Enter "ESC" "P" to preload data in the buffer. FUNC=P will be indicated on the screen. Data entered from the keyboard will be loaded in the buffer, which can be visually checked on the screen. Another "ESC" "P" transmits the data and deactivates the feature upon completion of the transmission. The transmission may be halted by the keystroke "ESC" "P". If you wish to transmit the rest of the data after the halt, enter another "ESC" "P". The buffer is cleared when "CTRL-X" or "ESC" "CR" is entered. "DEL" is effective for error correction, as long as the error is still in the buffer, prior to transmission.

Preloading status entry	"ESC" "P"
To transmit preloaded data	"ESC" "P"
To halt transmission	"ESC" "P"
To continue transmission after halt	"ESC" "P"
To clear the buffer	"CTRL-X" or "ESC" "CR"
Error correction	"DEL" or "ESC" "Z"

Channel Memory Transmission

The Theta-777 has 15 channels of message memory. The allocation is:

Channel #1, 2, 3, 4	64 characters
Channel #5, 6, 7, 8, 9, Ø	32 characters
Channel #A, B, C, D	16 characters (for Selcal data)
Channel #E	32 characters (for CW ID, Selcal Answer-back, QBF test message, 'Here Is' Message, etc.)

NOTE: Please understand that these channel memories are not backed up by batteries so the messages are cleared when power is turned off.

1. Programming

Press "ESC" "J" and then enter a number or letter from the keyboard to select a channel. Enter message and press "ESC" at the end.

Programming	"ESC" "J" + (channel) + (message) + "ESC"
Error Correction	"DEL"

2. Transmission

Press "ESC" "R", then the desired channel number (letter), and then the number of times of transmission.

"ESC" "R" + (channel) + number of times to be transmitted

NOTE: Programming is not possible during channel transmission.

Echo Back Transmission

The Theta-777 can receive and simultaneously retransmit data from an external device. The input should be either AF (eg. signals recorded on cassette tape) or TTL level (eg. electric keyer signals.)
To select input terminal, press "ESC" "4" for TTL level or press "ESC" "5" for AF.
The keystroke "ESC" "E" activates/deactivates the feature. FUNC=E will be indicated on the screen.

NOTE: This feature is not available in the AMTOR modes.

Test Messages

"ESC" "Q"	QBF	THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 123456789Ø DE (data memorized in Channel #E)
"ESC" "Y"	RY	RYRYRYRYRYRYRYRYRYRYRYRYRYRYRY.....
"ESC" "U"	CW random feature for CW practice	

Any keystroke will stop the QBF, RY or CW random signals.

Selcal (Selective Calling) System

RTTY

This is a system for receiving certain calls selectively among many other incoming calls. With this system, the Theta-777 decodes calls only when they accompany a set of signals previously agreed upon. In other words, all the calls at a frequency will be ignored except the ones with "password" (selcal) signals.

Two selcals are required for a station; one to open and another to close a contact. It is prerequisite for the system to store the selcals in channel memory.

NOTE: The selcal feature described here is not available in the AMTOR modes. In AMTOR, a different form of selcal is used.

1. Selcal programming siehe Seite 30

Channel	A	Opening Selcal of other station
	B	Closing Selcal of other station
	C	Opening Selcal of your station
	D	Closing Selcal of your station
	E	Answerback

Follow the procedure of programming in channel memories.

NOTE: The code for Opening Selcal of your station must be different from the Answerback code.

2. The keystroke "ESC" "C" activates the selcal feature. (The screen indication is FUNC=S.) Any data entered from the keyboard will be written in the buffer and may be sent.

3. Upon receipt of the proper selcal, the Theta-777 starts decoding and keys the REMOTE line for external equipment such as a tape recorder. Upon receipt of the closing selcal it unkeys the REMOTE line, keys the P.T.T. line temporarily to send Answerback.

4. Another "ESC" "C" deactivates the feature.

ESC J A message ESC

'WRU' (Who aRe yoU) Feature

The Theta-777 provides 'Who aRe yoU' control code. This feature is available also in AMTOR modes and allows a sending station to confirm the identity of the receiving station of this code. The keystroke "$" transmits 'WRU' control code.

On receiving the WRU code, the unit sends back 'HERE IS' message in the following procedure;

In Baudot and Bit Inversion modes	A few seconds after receiving the code, the unit unkeys the P.T.T. line and sends 'HERE IS' message, and then automatically keys the P.T.T. line.
In ARQ mode	Reception of the WRU code enables the unit to send back transmitting/receiving changeover code and then 'HERE IS' message and a second changeover code followingly. Both ISS and IRS simply press "$" to transmit WRU code and they automatically returns original ISS/IRS role after giving HERE IS message.
In FEC and SEL-FEC modes	When receiving the WRU code, the unit confirms that the sending station comes to be in a receiving state. After the confirmation, the unit unkeys the P.T.T. line and sends the HERE IS message, and then keys the P.T.T. line to return to the receiving state.

"HERE IS' message usually consists of HERE IS and your call sign. You are requested to program the message in channel E before the operation. The keyboard instruction for programming is "ESC" "J" "E" + message (your call sign) + "ESC".

In case using the WRU feature with a Baudot terminal, WRU control code corresponds to 'FIGS D' and is decoded as '$'. It may be confusing if the sending station intends to send the dollar sign and not requests a WRU identification. Therefore, it is recommended to program off the WRU feature unless it is used in your contact. On/off of WRU feature is available by the keystroke "ESC" "4".
When the WRU feature is activated, 'FUNC=W' is displayed on the screen.

NOTE: When the WRU feature is activated, '$' is not displayed on the screen even when the unit receives 'FIGS D' code. When the feature is deactivated, '$' is displayed on the screen.

Automatic Mode Selection Feature

Upon receipt of RTTY signal (Baudot, ASCII, JIS, Bit Inversion), the Theta-777 automatically judges its mode, speed and polarity, and starts decoding the signal.

Be sure to tune to the signal so that the maximum amplitude can be obtained for both Mark and Space tones.

Press "ESC" "M" "Ø". After certain time, the Theta-777 judges the speed, mode and polarity, and displays them on the screen. The indication of mode by the LED's on the front panel and by monitor will be 'ASCII' for ASCII or JIS mode, and 'BAUDOT' for Baudot or Bit Inversion mode. Decoded data will be displayed followingly.

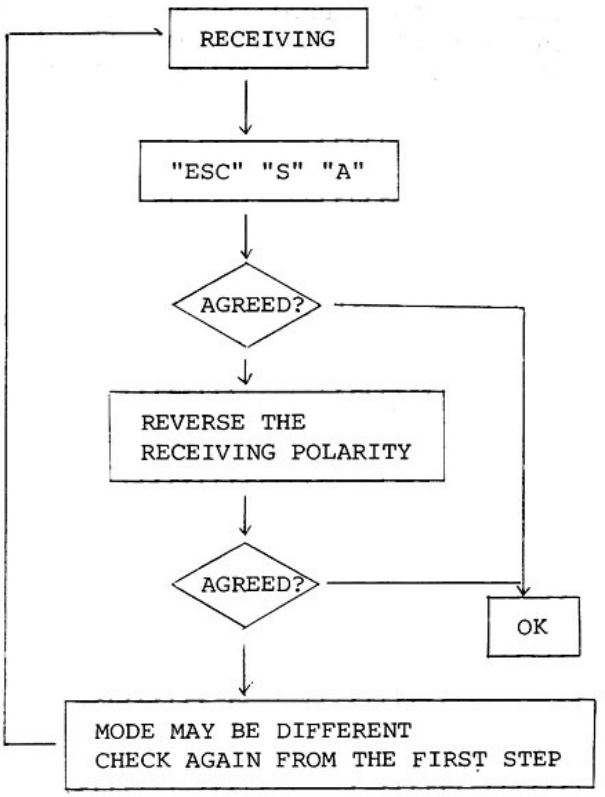
If signals cannot be decoded even when above procedure is repeated several times, the signal may be ciphered or of Bit Inversion mode, or may not be RTTY signal.

Autotrack of Speed

When mode is already known, the unit judges speed of a signal alone automatically.

Tune to the signal so that the maximum amplitude is obtained for both Mark and Space tones.
Press "ESC" "S" "A". Upon judgement, the speed is indicated on the screen such as 'SPEED=50BPS'.
Noise influence may cause the unit to display speed faster than the actual one. Please repeat the above procedure if necessary.

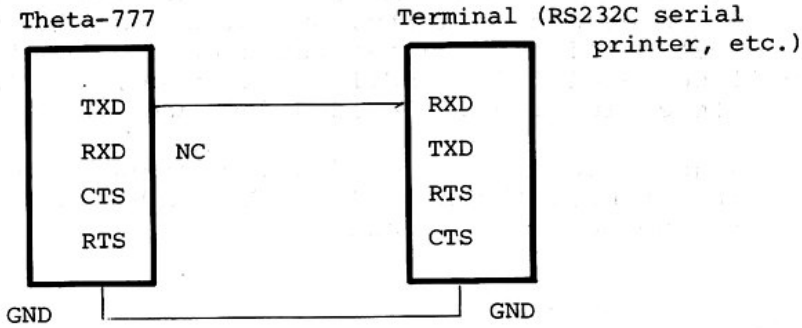
When either of mode, speed or polarity is not agreeing, the RQ LED on the front panel illuminates. In this case, operate as in the figure.



Application of Connection with RS232C Terminal

Utilizing the automatic mode selection feature, not only terminals with keyboard but any terminals which communicate by RS232C level signal can be connection with an RS232C serial printer.
The printer only receives data so is exclusive equipment for receiving.
The connection below may be a good example of basic way of connection with similar terminals.

example



NOTE: Mode should be set to half duplex.

In order to utilize the cable of the standard connection (full duplex mode) with D-SUB25 socket for this exclusive use of receiving, set the dip switches of the Theta-777 to HALF DUP and IN REV. Refer to page 20.
However, as for terminals which operate properly with IN REV state, switch to IN NOR position.
When the polarity (Mark/Space) of input signal is reversed, the LEDs on the front panel illuminate in order as shown by the figure on page 21 upon pressing the RESET button, and the automatic mode selection is enabled as a mode exclusively for receiving.

6.1 Basic Theory

A conventional RTTY signal consists of one start bit, five data bits and one stop bit. A start bit can synchronize the receiver decoding. Each signal can be separated from the following signal by a stop bit. However, there are some problems in this convenient start/stop system. Any noise or other interference which reverses the polarity of the receiving data bits results in misprinting. The start/stop bit can cause errors when mutilated. There is no way to confirm whether or not transmitted signals are decoded correctly by the distant receiver.

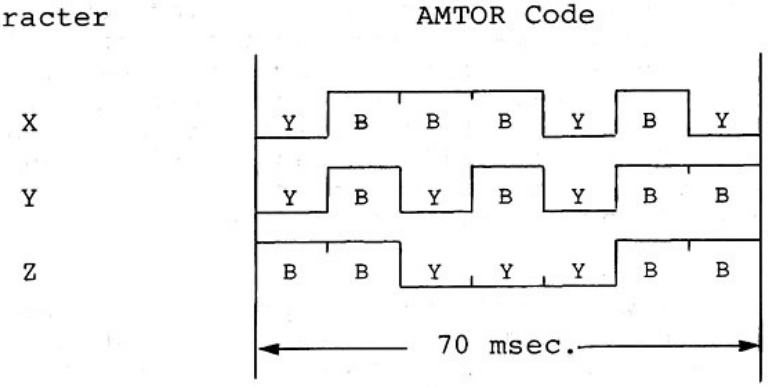
The AMTOR system was developed to improve the conventional system. The basic concept of AMTOR is to ensure that an error in the received signal will not cause an error in printing. This is achieved by transmitting extra information together with the data, if any. In this system a character is constructed with seven data bits, instead of five. Four bits are of one polarity (B, High frequency) and the rest are of the other (Y, Low frequency). There are 35 possible combinations of seven bits, and 32 of them are translated to the standard RTTY characters. The remaining three combinations are used as special control signals. Any received signal other than 4B3Y ratio is to be processed as an error.

The AMTOR system consists of three different modes. They are: Mode A (ARQ, Automatic Request), Mode B (FEC, Forward Error Correction) and Mode L (Listen to the ARQ contact).
Mode A is used for communication between two specified stations, in conjunction with a special selcal system. Mode B is for transmission to a large number of stations. It can be used for broadcast messages such as news or CQ calls. With mode L one can monitor Mode A (ARQ) communication betwen two other stations.
In Mode A, upon receipt of an error, the receiver automatically requests the transmitter to repeat the same signal till it is decoded correctly. In mode B, seven-bit characters are transmitted twice and the distant receivers select which of the two is of the 4B3Y ratio. Thus communication with the AMTOR system is considerably more reliable than conventional RTTY communication.

Data Construction

A character consists of seven data bits. Four bits of them are of B (High frequency) and the three are of Y (Low frequency). When any signal other than 4B3Y ratio is received, the receiver automatically requests the sending station to repeat the signal. It takes 70 msec. to transmit a seven-bit character at the speed of 100 bauds.

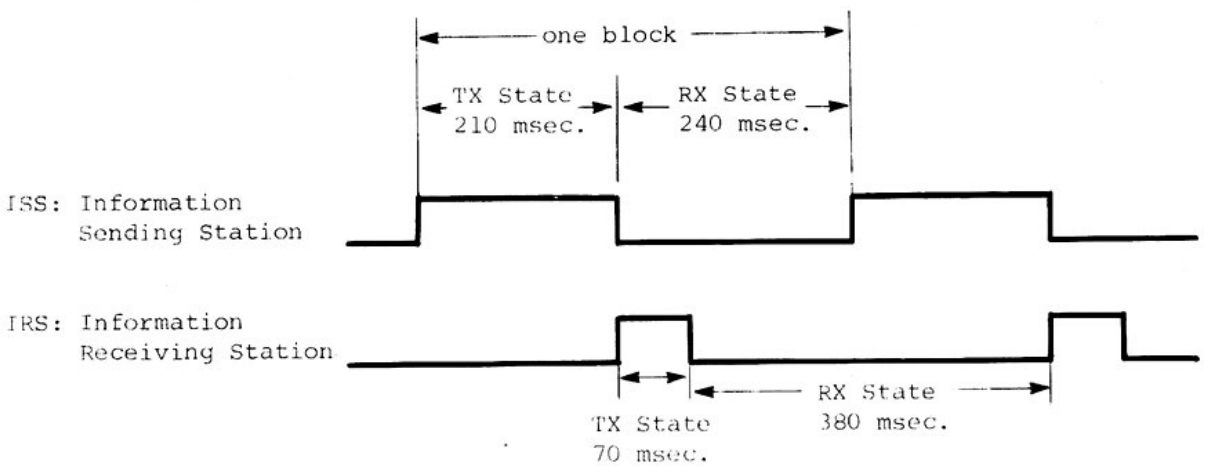
example of the construction



The Theta-777 operates AMTOR of RTTY system (The system based on the RTTY system), which works with Y frequency 1275Hz and 2125Hz, and Shift Width 170Hz, 425Hz and 850Hz which are used in the RTTY mode.

6.2 Mode A (ARQ, Automatic Request)

In AMTOR mode A, 450 msec. is considered as one block. During a block a group of three seven-bit characters (210 msec.) is transmitted serially, and then the transceiver switches to the receiving state for 240 msec. to receive a seven-bit control signal.
The control signal determines next group of three characters to be transmitted.



In case there is any signal detected to be an error, the same block will be retransmitted till it is decoded correctly. No error will be printed. Signals are transmitted block by block as shown above.

Some terms should be defined before discussing the operation in detail.

Master Station (MS): the station that starts the communication. (It does not mean who is sending data at any one time, but only who begins the contact.)

Slave Station (SS) : the station that is called by the MS.

Information Sending Station (ISS) : the station that is generating or sending data at a given moment. The term "transmitter" may also be used.

Information Receiving Station (IRS): the station that is receiving and printing data at a given moment. The term "receiver" may also be used.

The relation between the MS and the SS does not change even when the MS becomes IRS and vice versa.

The communication starts when a station (MS) calls the distant station (SS) with its selcal. Only the station whose selcal corresponds with the one transmitted is able to respond. On receiving its own selcal, the SS sends back the control signal. Signals are transmitted in the following procedure;

example To transmit "TNX FER UR CALL"

The transmitter sends the first three-character block, "TNX". The receiver replies with one control signal that says either, "Correctly received. Send the next three." or "Missed the group. Send it again."

During pauses in the keyboard typing or when signals fade out, idle signals are transmitted to maintain synchronization.

In case the signal fades out and nothing is received for more than 32 blocks while the MS is ISS, the MS automatically returns to PHASING state and the SS switches to WAITING state to regain synchronization. Similarly, if the same thing happens while the SS is ISS, the SS switches to WAITING state and the MS returns to PHASING state. As soon as getting synchronized, the SS returns to transmitting state and the MS does to receiving state.

The transmitting/receiving role changes when the ISS sends a changeover code. On receiving it, the IRS takes its turn to be a transmitter.

End of a contact is always initiated by the ISS. When the ISS transmits a signal to finish the contact, both ISS and IRS returns to the waiting state.

ARQ Operation

The keyboard instruction of the mode setting is "ESC" "M" "4".* The initial state (waiting status) is common to mode A, mode B and SEL-FEC mode. Following LEDs illuminate simultaneously in the waiting status; 'TOR-A', 'TOR-B', 'SEL-FEC' and 'WAIT'.

Before starting a contact, you are suggested to store your own selcal. The keyboard instruction is "ESC" "H" + four letters. To start a contact as a master station, transmit selcal of other ARQ station by pressing "ESC" "A" + four letters. You can start a contact as a slave station after getting synchronized.

LED indication changes to 'TOR-A' and 'PHASE' upon transmission of the selcal of other ARQ station, or 'TOR-A' and 'U.PHA' on getting synchronized. 'MAS' (Master) LED illuminates with red when you are ISS and green when you are IRS. 'SLV' (Slave) LED also illuminates with red when you are ISS and green when you are IRS. Refer to '6.7 Introduction to the LED Indicators' for other indications.

IRS's reception of a combination of '+' and '?' changes the transmitting/receiivng role. Upon receipt of the combination, IRS becomes ISS and vice versa. This feature is initiated only by ISS.

To return both ISS and IRS to the waiting status, the ISS should give a keystroke "TAB" or "ESC" "D". The keystroke "ESC" "W" returns only ISS to the waiting status.

*NOTE: When you use a Baudot terminal, press "BLANK" key instead of "ESC" because the 'ESC' code is not available with the Baudot terminal.

When your station is being called by a distant station in mode A and can not synchronize with it in spite that;

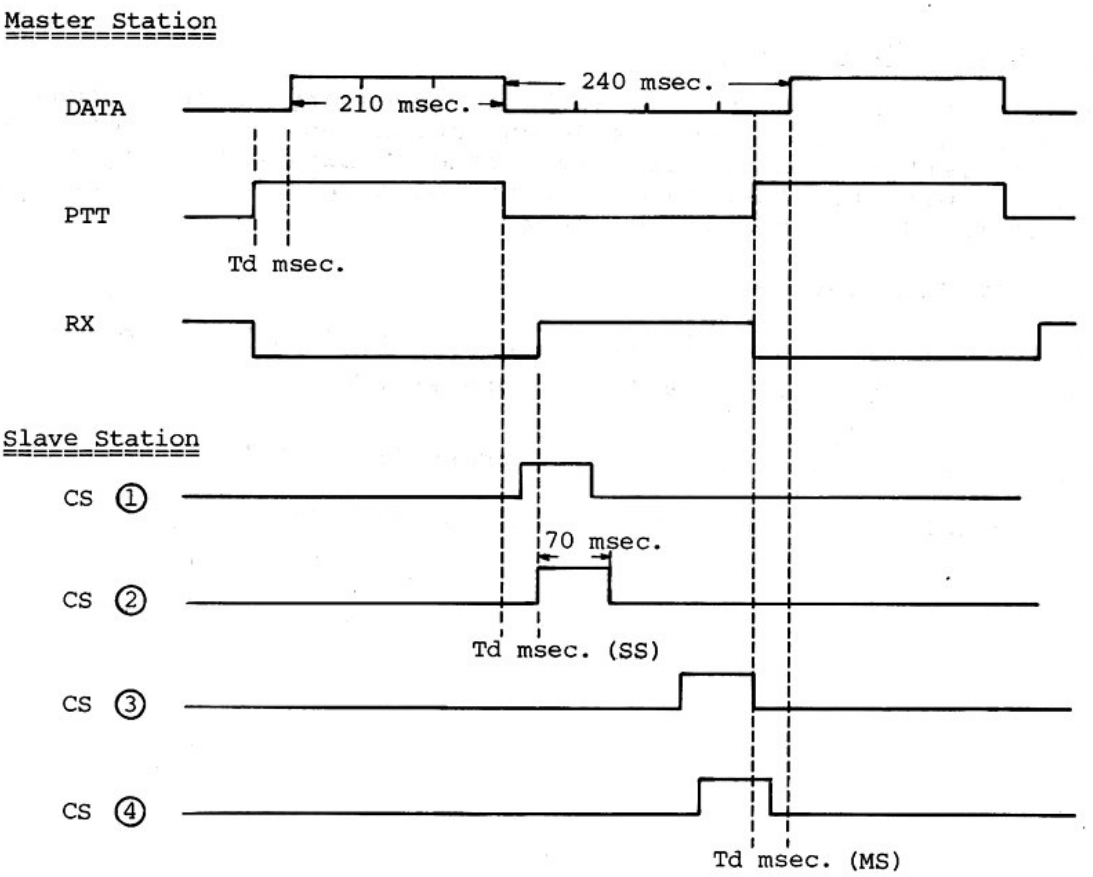
your selcal is memorized correctly
both Mark and Space LED bargraph meters illuminate
cross-hatch shows proper form

the polarity of the incoming signal may be reversed. Reverse the polarity of receiving by pressing "ESC" "0" "1" and see if this results in synchronization.
When the LED, 'U.PHA' illuminates for a while, the polarity of the output signal may be reversed. Reverse the polarity of transmission by pressing "ESC" "0" "2".

Similar problems in mode B, SEL-FEC mode or mode L may be solved in the same manner.

PTT Time Delay

The relation between data (Master station) and CS control signal (Slave station) is as shown below;



In the communication between near two stations, it may be possible that CS control signal sent by the slave station is not received perfectly because the CS signal arrives at the master station before it becomes in the RX state as shown in CS ①. Such state may occur because transceivers need certain time for TX/RX change-over. Therefore, the slave station is requested to make the PTT delay time (Td msec.) long enough so that the CS signal may be received perfectly.

In the communication between distant two stations, the same thing may happen because CS control signal does not arrive at the master station by the time when PTT line of the station is keyed as shown in CS ④. Therefore, the master station is requested to make the PTT delay time (Td msec.) short enough to receive the CS signal perfectly.

The time delay, "Td" can be varied by 2 msec.-step from 7 msec. through 43 msec. Td is indicated in the left part of the screen by pressing "ESC" "?". With the keystroke "ESC" "V", Td is decreased by 2 msec.-step. The initial value is set on 19 msec. Set Td in accordance with the time required for TX/RX changeover of your transceiver and the distance between two stations.

Break-In Feature

When IRS has necessity of transmitting message while ISS is still transmitting the data, the changeover of ISS/IRS role will be performed. The keyboard instruction is "ESC" "/". Careful attention should be paid to use this function.

Selcal for ARQ Operation

In order to operate in mode A, it is necessary to use selcal system. A selcal for the AMTOR communication consists of four capital letters* and is usually formed combining the first letter together with the last three letters of a call sign. Thus the selcal for JI1ZNZ should be "JZNZ".

*NOTE: Numbers are not to be used.

How to store your selcal ..... press "ESC" "H" + 4 letters

How to display your selcal* .... press "ESC" "?"

How to send selcal of other ARQ station ..... press "ESC" "A" + 4 letters

*NOTE: Your selcal is displayed following to 'HC='.

NOTE for the operation in AMTOR modes

1. Operate transceivers in USB mode.
2. Operation speed is fixed at 100 bauds.
3. Assign MARK frequency used in RTTY modes (1275 Hz and 2125 Hz) for Y frequency and SPACE frequency for B frequency.

6.3 Mode B (FEC, Forward Error Correction)

In mode B, message is transmitted unilateraly by one station to any number of stations. Transmitting/receiving changeover is not performed.

Signals are transmitted continuously at the speed of 100 bauds in the following procedure;

example To transmit "ABCDEF.*.GHI" (*... stands for typing pause)

$\overline{\text{PH2}}$ $\underline{\text{PH1}}$ $\overline{\text{PH2}}$ $\underline{\text{PH1}}$ $\overline{\text{A}}$ $\underline{\text{PH1}}$ $\overline{\text{B}}$ $\underline{\text{PH1}}$ $\overline{\text{C}}$ $\underline{\text{A}}$ $\overline{\text{D}}$ $\underline{\text{B}}$ $\overline{\text{E}}$ $\underline{\text{C}}$ $\overline{\text{F}}$ $\underline{\text{D}}$ $\overline{\text{PH2}}$ $\underline{\text{E}}$ $\overline{\text{PH2}}$ $\underline{\text{F}}$ $\overline{\text{G}}$ $\underline{\text{PH1}}$ $\overline{\text{H}}$ $\underline{\text{PH1}}$ $\overline{\text{I}}$

PH1 and PH2 represent phasing signals. They are transmitted regularly at the start of each contact and every 32 characters for synchronization. They are also sent when signals fade out temporarily. Each seven-bit character is transmitted again in five signals, so that the receiver can select which of the two passes the 4B3Y ratio test.

Operation in Mode B

Set the unit in mode B by pressing "ESC" "M" "4". The waiting state is common to mode A, mode B and SEL-FEC mode. The keyboard instruction "ESC" "B" starts transmission of mode B signal.

The keyboard instruction "ESC" "D" or "TAB" ends a contact, then both sending and receiving stations return to the waiting status. The keystroke "ESC" "W" returns only a sending station to the waiting status.

6.4 SEL-FEC (Selective Mode B)

SEL-FEC is for selective broadcast to one or more stations. Operation in this mode is very similar to that in FEC mode except that receiving stations are restricted to specified ones whose selcal correspond to that sent by a station sending in SEL-FEC mode.

The system of transmitting signal is same for FEC like that phasing signals are transmitted at the start of each contact for synchronization.* Each data is sent twice in every five signals so as to avoid any possible reception of error.

*NOTE: You have necessity of receiving the contact from the beginning for synchronization because phasing signals are transmitted only at the beginning of the contact.

The two differences from FEC mode are that first, the transmission of the selcal begins the contact as in ARQ mode. Only stations whose selcal match the one transmitted by a station sending in SEL-FEC mode are able to decode the message. Secondly, all transmitted signals are constructed with inverted 4B3Y-ratio code.

Operation in SEL-FEC Mode

Set the unit in SEL-FEC mode by pressing "ESC" "M" "4". The waiting status of SEL-FEC mode is common to mode A and mode B. The keystroke "ESC" "C" and four-letter-selcal of other SEL-FEC stations begins a contact. When you are the slave station, the Theta-777 judges first which mode of ARQ or FEC is transmitted as soon as receiving phasing signal. At this moment, LED indication changes from the waiting state to 'TOR-B'. Then the unit judges the mode to be SEL-FEC upon receiving any inverted data. LED indication of this moment becomes 'SEL-FEC'.

'REMOTE' LED illuminates when the selcal transmitted by a station sending in selective mode B corresponds to your selcal.

To end a contact, press "ESC" "D" or "TAB", so that both sending and receiving stations return to the waiting status.

Selcal for SEL-FEC Operation

To store your selcal ..... press "ESC" "F" + 4 letters

To display your selcal* ..... press "ESC" "?"

To transmit selcal of
other SEL-FEC station ..... press "ESC" "C" + 4 letters

***NOTE:** Your selcal is displayed following to 'GC='.

6.5 Mode L (Listen to TOR - ARQ, FEC, SEL-FEC)

In mode L the Theta-777 monitors an ARQ contact, FEC broadcast and SEL-FEC broadcast. This mode is used only for receiving.

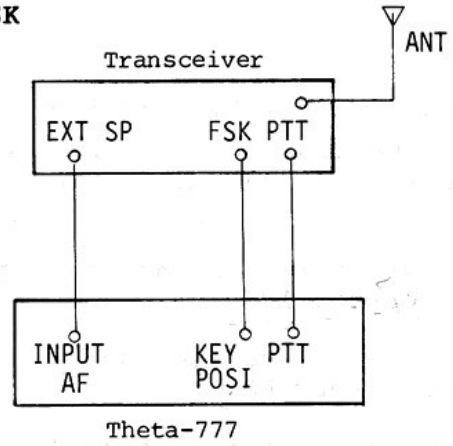
While monitoring an ARQ contact and a SEL-FEC broadcast, you may receive a meaningless four-letter combination repeatedly. This, however, does not always mean an error. Most of the time these four letters are the selcal of the slave station being called by a master station. The phenomenon often occurs when you monitor the contact which is trying to get synchronized.

example of the screen display; JZNZ JZNZ JZNZ JZNZ JZNZ

Setting of mode L is performed by pressing "ESC" "M" "5".

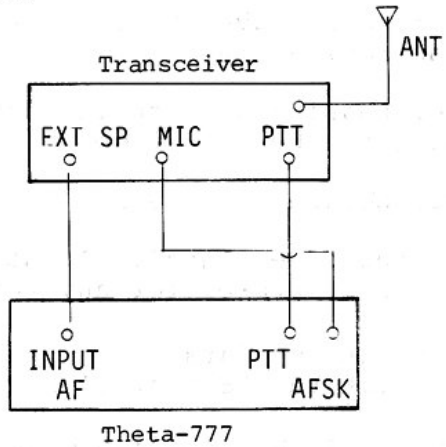
6.6 Connections

FSK



1) Emitted frequency is based on the FSK generator of your transceiver.
2) The FSK connection should be made the same as for RTTY (Baudot & ASCII).
3) Connect the PTT jacks of your transceiver and the Theta-777.

AFSK



1) The tone pair exclusive for ARQ/FEC codes, and both Low tone and High tone pair for RTTY use are available.
2) The connections should be made the same as for RTTY (Baudot & ASCII).
3) Connect the PTT jacks of your transceiver and the Theta-777.

FSK, CW OUT and AFSK OUT

LO tone, Shift Width 170 Hz

SENSE: OUT-N

Signal	B B B	Y Y Y	B
AFSK OUT	1445 Hz	1275 Hz	1445 Hz
FSK KEYER	ON	OFF	ON

SENSE: OUT-R

Signal	B B B	Y Y Y	B
AFSK OUT	1275 Hz	1445 Hz	1275 Hz
FSK KEYER	OFF	ON	OFF

6.7 Introduction to the LED Indicators

In mode A

TOR-A	indicates that the unit is operating in mode A. **NOTE:** TOR-A, TOR-B and SEL-FEC LEDs illuminate simultaneously in the waiting status. Indication changes to TOR-A as soon as transmit/receive any signal.
MAS	indicates that your station is the master station: red is for ISS and green for IRS
SLV	indicates that you are the slave station: red is for ISS and green for IRS
WAIT	waiting for a call from a distant station. (the initial state in mode A)
PHASE	Master station is calling a slave station with its selcal to achieve synchronization.
U.PHA	Slave station is under phasing and sending back a control code responding to the call from MS.
TRAFF	Transmit/receive state between MS and SS
IDLE	Transmitting or receiving idle signal. It starts idling when transmission is broken for any reason.
RQ	ISS is requested to repeat the data. IRS is requested to repeat the CS control signal.
ERR	Not able to receive data or CS control signal correctly.
REMOTE	indicates that the remote terminal on the rear panel is ON. Manual on/off switching is available by pressing "ESC" "N".
FIG	indicates that the case of transmitting/receiving signal is Figure. Manual LTR/FIG switching is available by pressing "ESC" "X".
LTR	indicates that the case of transmitting/receiving signal is Letter.
CS-1 CS-2	IRS transmits a control signal replying to the ISS's three-character data. CS-1 and CS-2 illuminate alternately. ISS receives a control signal from IRS. **NOTE:** When 'ERR' or 'RQ' LED illuminates indicating that three-character data are not received correctly, only CS-1 or CS-2 illuminates continuously.
CS-3	IRS transmits a control signal which makes an opportunity of ISS/IRS changeover. ISS receives the control signal.

in mode B

TOR-B — indicates that the unit is operating in mode B.

NOTE: TOR-A, TOR-B and SEL-FEC LEDs illuminate simultaneously in the waiting status. Indication changes to TOR-B as soon as transmit/receive any signal.

WAIT — waiting for a call from a distant station. (the initial state in mode B)

TRAFF — In transmit or receive state in mode B

IDLE — Transmitting or receiving idle signal when transmission is broken for any reason.

in SEL-FEC mode

SEL-FEC — indicates that the unit is operating in SEL-FEC mode.

NOTE: TOR-A, TOR-B and SEL-FEC LEDs illuminate simultaneously in the initial state. In transmission, LED indication changes to SEL-FEC upon transmission of any signal. In receiving, indication changes to FEC as soon as the unit judges the signal to be FEC, and then it changes to SEL-FEC upon receiving inverted 4B3Y ratio signal.

WAIT — waiting for a call from a distant station. (the initial state in SEL-FEC mode)

TRAFF — In transmitting/receiving state in SEL-FEC mode

IDLE — Transmitting or receiving idle signal when transmission is broken for any reason.

REMOTE — indicates that the selcal transmitted from a station sending in SEL-FEC mode corresponds to your own selcal when you are the station receiving in SEL-FEC mode. Remote terminal on the rear panel becomes on.

in mode L

TOR-L — indicates that the unit is operating in mode L.

WAIT — waiting for receiving signals. (the initial state in mode L)

TRAFF — receiving contacts operating in ARQ, FEC and SEL-FEC.

IDLE — receiving idle signal sent when transmission is broken for any reason.

RQ — receiving three continuous "RQ" signals.

ERR — receiving the same three-character-block.

7. VARIOUS FUNCTION KEYS

"ESC" "A" + 4 letters* *NOTE 1
transmits selcal of other ARQ station.

"ESC" "B" starts transmission in AMTOR mode B.

"ESC" "C" activates/deactivates selcal function in other modes than AMTOR.

"ESC" "C" + 4 letters
transmits selcal of other station in SEL-FEC mode.

"ESC" "D" or "TAB"
unkeys the P.T.T. line when in automatic P.T.T. line keying.
keys/unkeys the P.T.T. line when in manual P.T.T. line keying.

- in AMTOR modes
  returns both ISS and IRS to the waiting status.

"ESC" "E" activates/deactivates Echo Back function.

"ESC" "F" + 4 letters
programs your own selcal in SEL-FEC mode.

"ESC" "G" + 5 digit-combination of 1 and 0* *NOTE 2
inverts the polarity of the desired bit of 5-bit baudot code in Bit Inversion mode. Insert 1 to the bit you want to invert.

"ESC" "G" "2" increases the value by one considering the five-digit-combination as a numerical value in binary notation.* *NOTE 3

"ESC" "H" + 4 letters
programs your own selcal in ARQ mode.

"ESC" "I" transmits CW ID in RTTY (BAUDOT, ASCII & JIS) modes.

"ESC" "J" + channel number + message + "ESC"
enables channel memory programming. (Refer to page 30 for details.)

"ESC" "K" "1" automatic /manual P.T.T. line keying is available.

"ESC" "K" "3" - in Japanese CW mode
judges '-...-' code to be ✗ . Another key-stroke judges the code to be $\overline{BT}$.

- in Baudot mode
  activates/deactivates U.S.O.S. feature.

"ESC" "K" + "4", "5" or "6"
selects input terminal.(4=TTL, 5=AF, 6=ANTI NOISE)

"ESC" "L" + "Ø", "1", "2" or "3"
selects automatic CR/LF insertion. (Ø=non, 1=64 char., 2=72 char., 3=80 char.)

"ESC" "M" + "1" or "2" through "8"
selects desired mode. (1=ASCII, 2=JIS, 3=BAUDOT, 4=AMTOR mode A, B and SEL-FEC, 5=AMTOR mode L, 6=Bit Inversion, 7=Continental CW, 8=Japanese CW)

"ESC" "M" "Ø" automatically judges mode, speed and polarity of received RTTY signal and starts decoding the signal.

"ESC" "O" + "1" or "2"
reverses/normalizes the polarity of signals. (1=receiving signal, 2=transmitting signal)

"ESC" "P" activates data preloading/buffer transmission.

"ESC" "Q" outputs QBF test message. Any keystroke stops the transmission.

"ESC" "R" + channel number + number (1-9)
transmits the message memorized in each channel memory desired times.
(Refer to 4. DATA TRANSMISSION chapter.)

"ESC" "S" "A" Autotrack of speed is available. The speed is indicated on the screen.

"ESC" "N" Manual on/off switching of REMOTE terminal.

"ESC" "O" + "1" or "2"
reverses/normalizes the polarity of signals. (1=receiving signal, 2=transmitting signal)

"ESC" "P" activates data preloading/buffer transmission.

"ESC" "Q" outputs QBF test message. Any keystroke stops the transmission.

"ESC" "R" + channel number + number (1-9)
transmits the message memorized in each channel memory desired number of times.
(Refer to 4. DATA TRANSMISSION chapter.)

"ESC" "S" + 3 digits
speed setting

"ESC" "S" "C" returns the initial speed setting to the factory original setting.

"ESC" "S" "R" programs the desired speed setting of the mode.

"ESC" "T" + "1" or "2" through "6"
tone setting

"ESC" "U" starts CW random output. Any keystroke stops the transmission.

"ESC" "V" decreases delay time (Td msec.) by 2 msec.-step.

"ESC" "W" returns only ISS to the waiting status in AMTOR modes.

"ESC" "W" + number (Ø-9)
CW weight setting; 1:3 - 1:7

"ESC" "X" changes the case of received signal in Japanese CW, BAUDOT or AMTOR modes.

"ESC" "Y" transmits "RY" test message. Any keystroke stops the transmission.

"ESC" "Z" or "DEL"
deletes miswritten characters in the buffer or channel memory.* ***NOTE 4**

"ESC" "4" activates/deactivates automatic reply to 'WRU' control code.

"ESC" "/" - in ARQ mode
IRS transmits ISS/IRS changeover code to ISS. Upon ISS's receipt of the code, IRS becomes ISS and vice versa.

- in BAUDOT mode
activates/deactivates Diddle feature.

"ESC" "?" displays operating status and your own selcal on the screen.

"ESC" "CR" or "CTRL-X"
" clears the buffer memory.

"+" "?" switches transmitting and receiving role in ARQ mode. ISS should send combination of '+' and '?'. Upon receipt of these two signals, IRS becomes ISS and vice versa.

"$" or "WRU" transmits 'WRU' control code in ARQ, FEC, SEL-FEC, BAUDOT and Bit Inversion modes.

NOTE 1: When you use a Baudot terminal, press "BLANK" key instead of "ESC" because the 'ESC' code is not available with the Baudot terminal.

NOTE 2 When more than 5 digits are inserted, the last 5 digits are valid. If other characters than 1 and 0, the unit gets out of this function.

NOTE 3 When other character than 2 is pressed, the unit gets out of this function.

NOTE 4 Only 'DEL" key is available to deletes miswritten characters in the channel memory.

Recording

Set the mode and speed.
Connect AFSK OUT jack to the microphone terminal of the cassette tape recorder.
Set GAIN control of the back panel to the medium level so as to prevent excess input to the recorder.
Set the recorder in recording status.
Send the data which you want to record from the Theta-777.
Stop the recorder after the data transmission is completed. Make sure to let the cassette tape run for a few seconds before stopping.

Play Back

Adjust the mode and speed to the recording state of cassette tape recorder.
Clear the screen if required.
Connect the microphone terminal to INPUT AF jack in other modes than ARQ and FEC.
Adjust the volume of the recorder to make output level about 100mV to 1Vp-p. Any tone should be adjusted to the highest position at this moment.
Sentences are read and displayed on the screen when playback starts. Depressing "ESC" "E" activates the ECHO-BACK function and the unit outputs the received data to AFSK, CW, FSK jacks at the same time as the reading. You can use another tape recorder for storage.
To release this function, redepress "ESC" "E".

9. MAINTENANCE

Do not open the unit unnecessarily unless for purposes specified below nor do not touch the parts not corresponding to each purposes even in such cases.

Turn the power off and pull out the plug of power supply cord before opening the unit. Remove four pieces of M3 screw at the top case to open the unit.

Cross-hatch Tuning

The X and Y terminals for the cross-hatch tuning aid are on the PC board. Please refer to the **Oscilloscope** section on page 9.

Dip Switches Setting

The speed and mode are selected by eight dip switches on the PC board according to a microcomputer. Refer to **Setting of the Dip Switches** section on page 20.

Fuse Replacement

The replacement must be done after eliminating the cause why the fuse burns out. Replace the fuse which is in the fuse holder on the PC board with a midget fuse of 2A.

Please inquire of our distributor/dealer in your district regarding adjustment or when you have a problem with the unit.

When sending a unit to our distributor, please include a complete description of any and all problems.

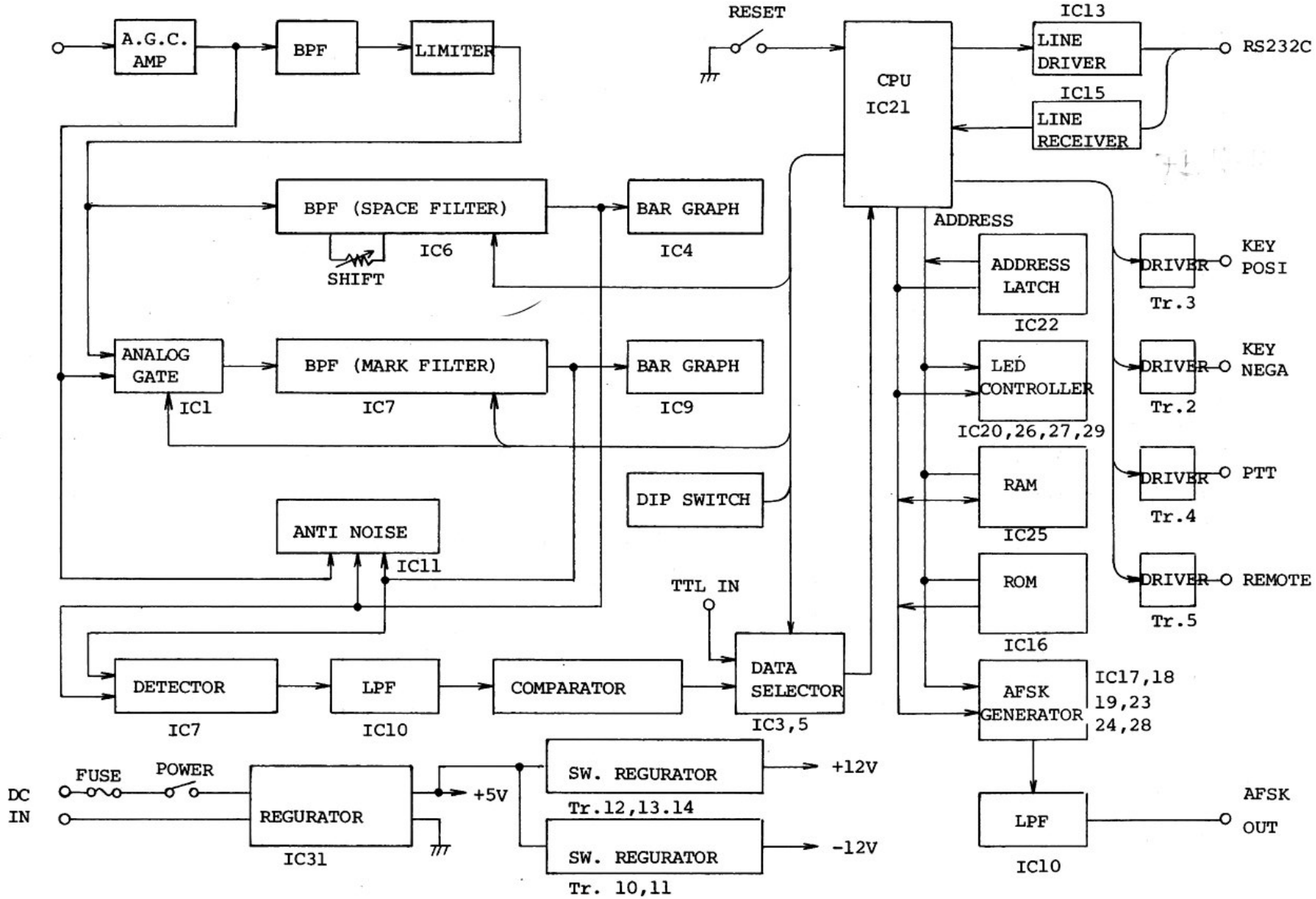
CODE TABLE

KEY	ASCII		BAUDOT (CCITT NO.2) ARQ/FEC/SEL-FEC		MORSE	
	SCREEN DISPLAY	OUTPUT CODE	SCREEN DISPLAY	OUTPUT CODE	SCREEN DISPLAY	OUTPUT CODE
!	!	! (21H)	!	!	!	..--. (UNDERSTOOD)
1	1	1 (31H)	1	1	1	.----
"	"	" (22H)	BLK	LTR	"	.-..-.
2	2	2 (32H)	2	2	2	..---
#	#	# (23H)	#	#	#	-.-.- (STARTING)
3	3	3 (33H)	3	3	3	...--
$	$	$ (24H)	$	WRU	$	...-..-
4	4	4 (34H)	4	4	4	....-
%	%	% (25H)	BLK	LTR	BLK	SP
5	5	5 (35H)	5	5	5	.....
&	&	& (26H)	&	&	BLK	SP
6	6	6 (36H)	6	6	6	-....
'	'	' (27H)	'	'	'	.----.
7	7	7 (37H)	7	7	7	--...
(	(	((28H)	(	(	(CR/LF	-.--. ((, $\overline{KN}$)
8	8	8 (38H)	8	8	8	---..
)	)	) (29H)	)	)	)	-.--.-
9	9	9 (39H)	9	9	9	----.
	SP	SP (2ØH)	SP	SP	SP	SP
Ø	Ø	Ø (3ØH)	Ø	Ø	Ø	-----
=	=	= (3DH)	=	=	=	-...- (=, $\overline{BT}$)
-	-	- (2DH)	-	-	-	-....-
~	~	~ (7EH)	BLK	LTR	BLK	SP
^	^	^ (5EH)	BLK	LTR	^	.-... ($\overline{AS}$)
¦	¦	¦ (7CH)	BLK	LTR	BLK	SP
\	\	\ (5CH)	BLK	LTR	\	.-..- (SEPARATION)
	q	q (71H)	Q	Q	Q	--.-
Q	Q	Q (51H)	Q	Q	Q	--.-
	w	w (77H)	W	W	W	.--
W	W	W (57H)	W	W	W	.--
	e	e (65H)	E	E	E	.
E	E	E (45H)	E	E	E	.
	r	r (72H)	R	R	R	.-.
R	R	R (52H)	R	R	R	.-.
	t	t (74H)	T	T	T	-
T	T	T (54H)	T	T	T	-

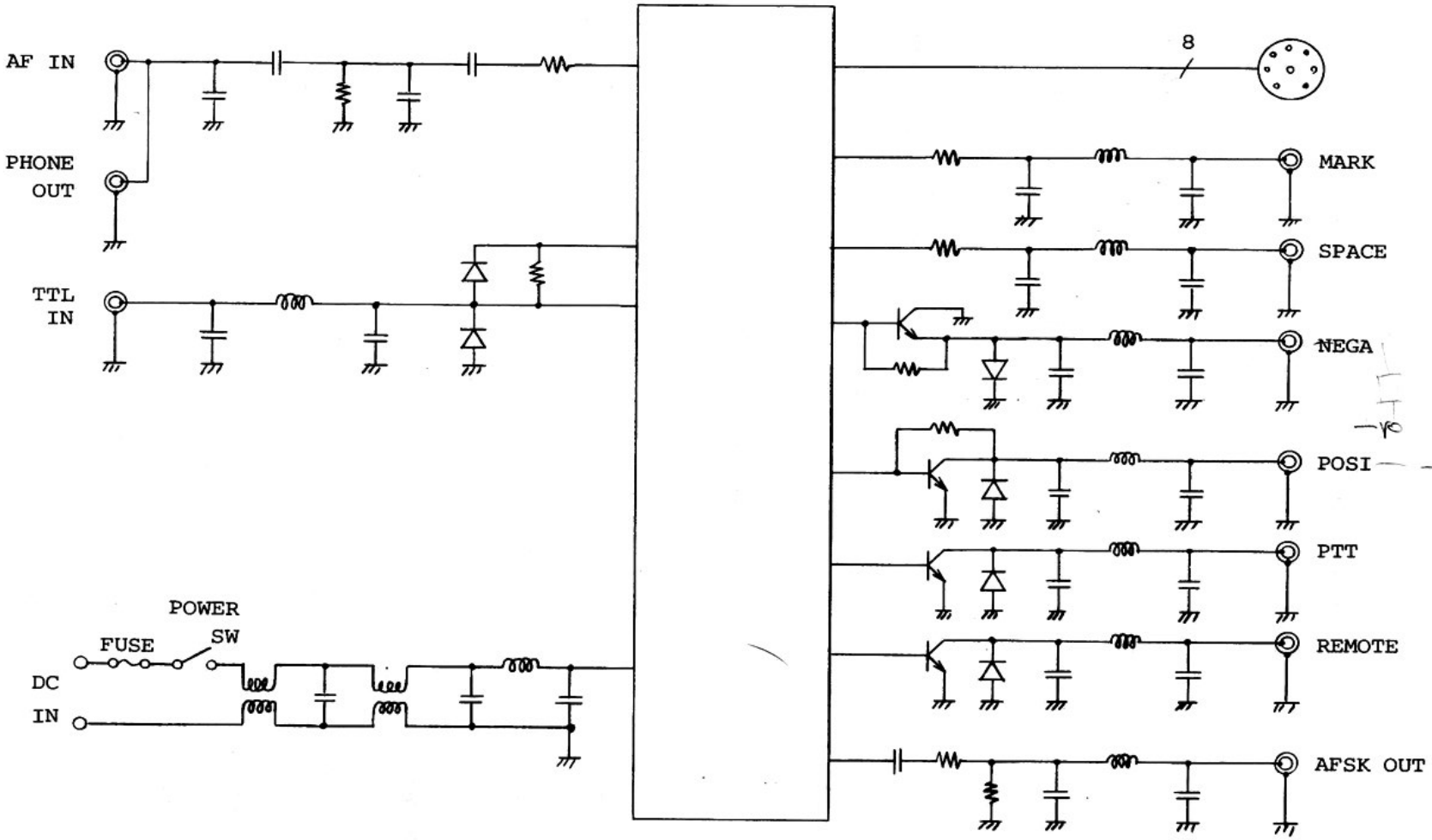
KEY	ASCII		BAUDOT (CCITT NO.2) ARQ/FEC/SEL-FEC		MORSE	
	SCREEN DISPLAY	OUTPUT CODE	SCREEN DISPLAY	OUTPUT CODE	SCREEN DISPLAY	OUTPUT CODE
	y	y (79H)	Y	Y	Y	-·--
Y	Y	Y (59H)	Y	Y	Y	-·--
	u	u (75H)	U	U	U	··-
U	U	U (55H)	U	U	U	··-
	i	i (69H)	I	I	I	··
I	I	I (49H)	I	I	I	··
	o	o (6FH)	O	O	O	---
O	O	O (4FH)	O	O	O	---
	p	p (7OH)	P	P	P	·--·
P	P	P (5OH)	P	P	P	·--·
\	\	\ (6OH)	BLK	LTR	BLK	SP
@	@	@ (4OH)	BLK	LTR	@	·--·-
{	{	{ (7BH)	BLK	LTR	BLK	SP
[	[	[(5BH)	BLK	LTR	BLK	SP
	a	a (61H)	A	A	A	·-
A	A	A (41H)	A	A	A	·-
	s	s (73H)	S	S	S	···
S	S	S (53H)	S	S	S	···
	d	d (64H)	D	D	D	-··
D	D	D (44H)	D	D	D	-··
	f	f (66H)	F	F	F	··-·
F	F	F (46H)	F	F	F	··-·
	g	g (67H)	G	G	G	--·
G	G	G (47H)	G	G	G	--·
	h	h (68H)	H	H	H	····
H	H	H (48H)	H	H	H	····
	j	j (6AH)	J	J	J	·---
J	J	J (4AH)	J	J	J	·---
	k	k (6BH)	K	K	K	-·-
K	K	K (4BH)	K	K	K	-·-
	l	l (6CH)	L	L	L	·-··
L	L	L (4CH)	L	L	L	·-··
+	+	+ (2BH)	+	+	+ CR/LF	·-·-· (+, $\overline{AR}$)
;	;	; (3BH)	;	;	;	-·-·-·
*	*	* (2AH)	BLK	LTR	* CR/LF	···-·- ($\overline{VA}$)
:	:	: (3AH)	:	:	:	---···
}	}	} (7DH)	BLK	LTR	BLK	SP
]	]	] (5DH)	BLK	LTR	BLK	SP

KEY	ASCII		BAUDOT(CCITT NO.2) ARQ/FEC/SEL-FEC		MORSE	
	SCREEN DISPLAY	OUTPUT CODE	SCREEN DISPLAY	OUTPUT CODE	SCREEN DISPLAY	OUTPUT CODE
	z	z (7AH)	Z	Z	Z	--..
Z	Z	Z (5AH)	Z	Z	Z	--..
	x	x (78H)	X	X	X	-..-
X	X	X (58H)	X	X	X	-..-
	c	c (63H)	C	C	C	-.-.
C	C	C (43H)	C	C	C	-.-.
	v	v (76H)	V	V	V	...-
V	V	V (56H)	V	V	V	...-
	b	b (62H)	B	B	B	-...
B	B	B (42H)	B	B	B	-...
	n	n (6EH)	N	N	N	-.
N	N	N (4EH)	N	N	N	-.
	m	m (6DH)	M	M	M	--
M	M	M (4DH)	M	M	M	--
<	<	< (3CH)	BLK	LTR	BLK	..... (HH)
,	,	, (2CH)	,	,	,	--..--
>	>	> (3EH)	BLK	LTR	BLK	SP
.	.	. (2EH)	.	.	.	.-.-.-
?	?	? (3FH)	?	?	?	..--..
/	/	/ (2FH)	/	/	/	-..-.
_	_	_ (5FH)	BLK	LTR	_	..--.-
_	_	_ (5FH)	BLK	LTR	_	..--.-
CR	CR	CR (ØDH)	CR	CR	CR	SP
LF	LF	LF (ØAH)	LF	LF	LF	SP

BLOCK DIAGRAM



INPUT/OUTPUT CIRCUIT



SPECIFICATIONS

Code	Morse (Continental & Japanese CW), ASCII (RTTY), Baudot (RTTY), JIS (RTTY), ARQ (AMTOR MODE A, MODE L), FEC (AMTOR MODE B), SEL-FEC, BIT-INVERSION
Speed	Morse Receiving: 5 - 100 Words/Minute (AUTOTRACK) Transmitting: 5 - 100 Words/Minute RTTY (Baudot, ASCII, JIS) 12 - 200 bauds TTL Level (Baudot, ASCII, JIS) 12 - 600 bauds ARQ/FEC 100 bauds
Input	AF Input / TTL Level Input Impedance: 8 ohms
AF Input Frequency	CW: 830Hz RTTY (Baudot, ASCII, JIS): Mark 1275Hz (Low Tone), 2125Hz (High Tone) Shift 170Hz - 850Hz (Variable Shift)
Output	Keying Output: CW ..... 80mA, 200V FSK .... 80mA, 200V AFSK Output Impedance: 600 ohms PTT, REMOTE Output: 300mA
AFSK Output Frequency	CW: 830Hz RTTY (Baudot, ASCII, JIS): Mark 1275Hz (Low Tone), 2125Hz (High Tone) Shift 170Hz, 425Hz, 850Hz
Interface	RS232C, TTL Level ASCII ..... Full Duplex, Half Duplex Baudot Code ..... Half Duplex
Buffer Memory	Input Buffer Memory: 768 characters Output Buffer Memory: 512 characters
Message Memory	64 characters x 4 channels 32 characters x 7 channels 16 characters x 4 channels
Output Impedance for Oscilloscope	200K ohms
Power Supply	DC 12V, 700mA
Dimensions	234 mm (W) x 256 mm (D) x 64 mm (H)
Accessories	Instruction Manual - 1, Pin Plug - 8, Coasial Cable - 4m, 8P DIN Connector - 1

The Theta-777 should be operated under condition of temperature 5°C - 40°C.

The specifications are subject to change without prior notice.

APPENDIX - a sample program for the APPLE II

SOURCE LIST

```
!ASM
**END OF PASS 1
**END OF PASS 2
0800           1     ; DRIVER PROGRAM FOR THETA-777
0800           2     ;WITH APPLE II
0800           3     ; VERSION 1.0 OPERATING SYSTEM
0800           4     ;
0800           5     ; PLEASE SET BAUD RATE TO
0800           6     ;300,600,1200 OR 2400 BAUD
0800           7     ;
0800           8     ; PROGRAM WRITTEN
0800           9     ;BY A.NISHIYAMA (JG1LBH)
0800           10    ;
0800           11    ; 28/NOV/1984
0800           12    ;
0800           13    ;SYSTEM MONITOR
0800           14    INI     EQU $FB2F
0800           15    HOME    EQU $FC58
0800           16    COUT1   EQU $FDF0
0800           17    ;I/O
0800           18    RXD     EQU $C0A5
0800           19    TXD     EQU $C0A5
0800           20    SR      EQU $C0A4
0800           21    CR      EQU $C0A4
0800           22    ;
0800           23    KBD     EQU $C000
0800           24    KBDSTB  EQU $C010
0800           25    ;SYSTEM
0800           26    CH      EPZ $24
0800           27    CV      EPZ $25
0800           28    BASL    EPZ $28
0800           29    ACC     EPZ $45
0800           30    OUTCS1  EPZ $EB
0800           31    OUTCS2  EPZ $EC
0800           32    INCS1   EPZ $ED
0800           33    INCS2   EPZ $EE
0800           34    ;
0800           35    OUTBFF  EQU $900
0800           36    INBFF   EQU $A00
0800           37    ;***************
0800           38            ORG $800
0800           39    START :
0800           40    ;INTERRUPT DISABLE
0800 78        41            SEI
0801 4C1608    42            JMP INIT
0804           43    ;
0804           44    ;*************
0804           45    ;* INTERRUPT *
0804           46    ;*************
0804           47    IRQ   :
0804 8A        48            TXA
0805 48        49            PHA
0806 ADA5C0    50            LDA RXD
0809 A6EB      51            LDX OUTCS1
080B 9D0009    52            STA OUTBFF,X
080E E8        53            INX
080F 86EB      54            STX OUTCS1
0811 68        55            PLA
0812 AA        56            TAX
0813 A545      57            LDA ACC
0815 40        58            RTI
```

```
0816            59    ;******
0816            60    ; MAIN
0816            61    ;******
0816            62    INIT   :
0816 202FFB     63           JSR INI
0819 2058FC     64           JSR HOME
081C A9FF       65           LDA #$FF
081E 8532       66           STA $32
0820 A904       67           LDA #IRQ
0822 8DFE03     68           STA $3FE
0825 A908       69           LDA /IRQ
0827 8DFF03     70           STA $3FF
082A A900       71           LDA #$0
082C 85EB       72           STA OUTCS1
082E 85EC       73           STA OUTCS2
0830 85ED       74           STA INCS1
0832 85EE       75           STA INCS2
0834 A903       76           LDA #$3
0836 8DA4C0     77           STA CR
0839 A995       78           LDA #$95
083B 8DA4C0     79           STA CR
083E            80    ;INTERRUPT ENABLE
083E 58         81           CLI
083F            82    LOOP   :
083F A5EB       83           LDA OUTCS1
0841 C5EC       84           CMP OUTCS2
0843 F01F       85           BEQ GETKEY
0845 A6EC       86           LDX OUTCS2
0847 BD0009     87           LDA OUTBFF,X
084A E8         88           INX
084B 86EC       89           STX OUTCS2
084D 0980       90           ORA #$80
084F            91    ;MASK LINE FEED
084F AA         92           TAX
0850 C98A       93           CMP #$8A
0852 F010       94           BEQ GETKEY
0854 8A         95           TXA
0855            96    ;ERASE CORSOR
0855 48         97           PHA
0856 A424       98           LDY CH
0858 B128       99           LDA (BASL),Y
085A 293F       100          AND #$3F
085C 0980       101          ORA #$80
085E 9128       102          STA (BASL),Y
0860 68         103          PLA
0861            104   ;
0861 20F0FD     105          JSR COUT1
0864            106   ;WRITE CURSOR
0864            107   GETKEY:
0864 A424       108          LDY CH
0866 B128       109          LDA (BASL),Y
0868 293F       110          AND #$3F
086A 9128       111          STA (BASL),Y
```

```
086C           112  ;KEY INPUT
086C 2C00C0    113          BIT KBD
086F 1012      114          BPL GETKY1
0871 AD00C0    115          LDA KBD
0874 2C10C0    116          BIT KBDSTB
0877 297F      117          AND #$7F
0879 48        118          PHA
087A A6ED      119          LDX INCS1
087C 9D000A    120          STA INBFF,X
087F E8        121          INX
0880 86ED      122          STX INCS1
0882 68        123          PLA
0883           124  GETKY1:
0883 ADA4C0    125          LDA SR
0886 2902      126          AND #$2
0888 F0B5      127          BEQ LOOP
088A           128  ;
088A A5ED      129          LDA INCS1
088C C5EE      130          CMP INCS2
088E F0AF      131          BEQ LOOP
0890           132  ;TXDATA FROM BUFFER
0890 A6EE      133          LDX INCS2
0892 BD000A    134          LDA INBFF,X
0895 E8        135          INX
0896 86EE      136          STX INCS2
0898           137  OUT    :
0898 8DA5C0    138          STA TXD
089B 4C3F08    139          JMP LOOP
               140          END
***** END OF ASSEMBLY
```

```
            **************************
            *                        *
            * SYMBOL TABLE -- V 1.0  *
            *                        *
            **************************
```

LABEL.	LOC.	LABEL.	LOC.	LABEL.	LOC.
CH	0024	CV	0025	BASL	0028
ACC	0045	OUTCS1	00EB	OUTCS2	00EC
INCS1	00ED	INCS2	00EE	INI	FB2F
HOME	FC58	COUT1	FDF0	RXD	C0A5
TXD	C0A5	SR	C0A4	CR	C0A4
KBD	C000	KBDSTB	C010	OUTBFF	0900
INBFF	0A00	START	0800	IRQ	0804
INIT	0816	LOOP	083F	GETKEY	0864
GETKY1	0883	OUT	0898		

DUMP LIST

```
*800.89F
0800- 78 4C 16 08 8A 48 AD A5
0808- C0 A6 EB 9D 00 09 E8 86
0810- EB 68 AA A5 45 40 20 2F
0818- FB 20 58 FC A9 FF 85 32
0820- A9 04 8D FE 03 A9 08 8D
0828- FF 03 A9 00 85 EB 85 EC
0830- 85 ED 85 EE A9 03 8D A4
0838- C0 A9 95 8D A4 C0 58 A5
0840- EB C5 EC F0 1F A6 EC BD
0848- 00 09 E8 86 EC 09 80 AA
0850- C9 8A F0 10 8A 48 A4 24
0858- B1 28 29 3F 09 80 91 28
0860- 68 20 F0 FD A4 24 B1 28
0868- 29 3F 91 28 2C 00 C0 10
0870- 12 AD 00 C0 2C 10 C0 29
0878- 7F 48 A6 ED 9D 00 0A E8
0880- 86 ED 68 AD A4 C0 29 02
0888- F0 B5 A5 ED C5 EE F0 AF
0890- A6 EE BD 00 0A E8 86 EE
0898- 8D A5 C0 4C 3F 08 FF FF
*
```

As for the APPLE II, connect no. 7 pin of 6850 of the communication card and no. 30 pin of the peripheral slot - which means to jumper $\overline{IRQ}$.
Insert the communication card to no. 2 slot and run the program. The starting address is $800.

TONO CORPORATION

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