RS 2100

RTTY SCOPE

INSTRUCTION
MANUAL

HAL COMMUNICATIONS CORP.
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URBANA, ILLINOIS 61801

QUALITY COMMUNICATIONS EQUIPMENT

R S 2 1 0 0

R T T Y   S C O P E

RS2100 RTTY SCOPE

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INTRODUCTION

This manual describes the installation and operation of the HAL RS2100
RTTY Scope. The features of the RS2100 have been designed for conven-
ient and straightforward use; many features are self-explanatory from
a close examination of the RS2100 front panel or rear panel. However,
like many sophisticated electronic devices, there are some features
and operator techniques which you may not understand until you have
read this manual. You should plan to devote several hours to becoming
familiar with your RS2100.

Figure 1   The RS2100
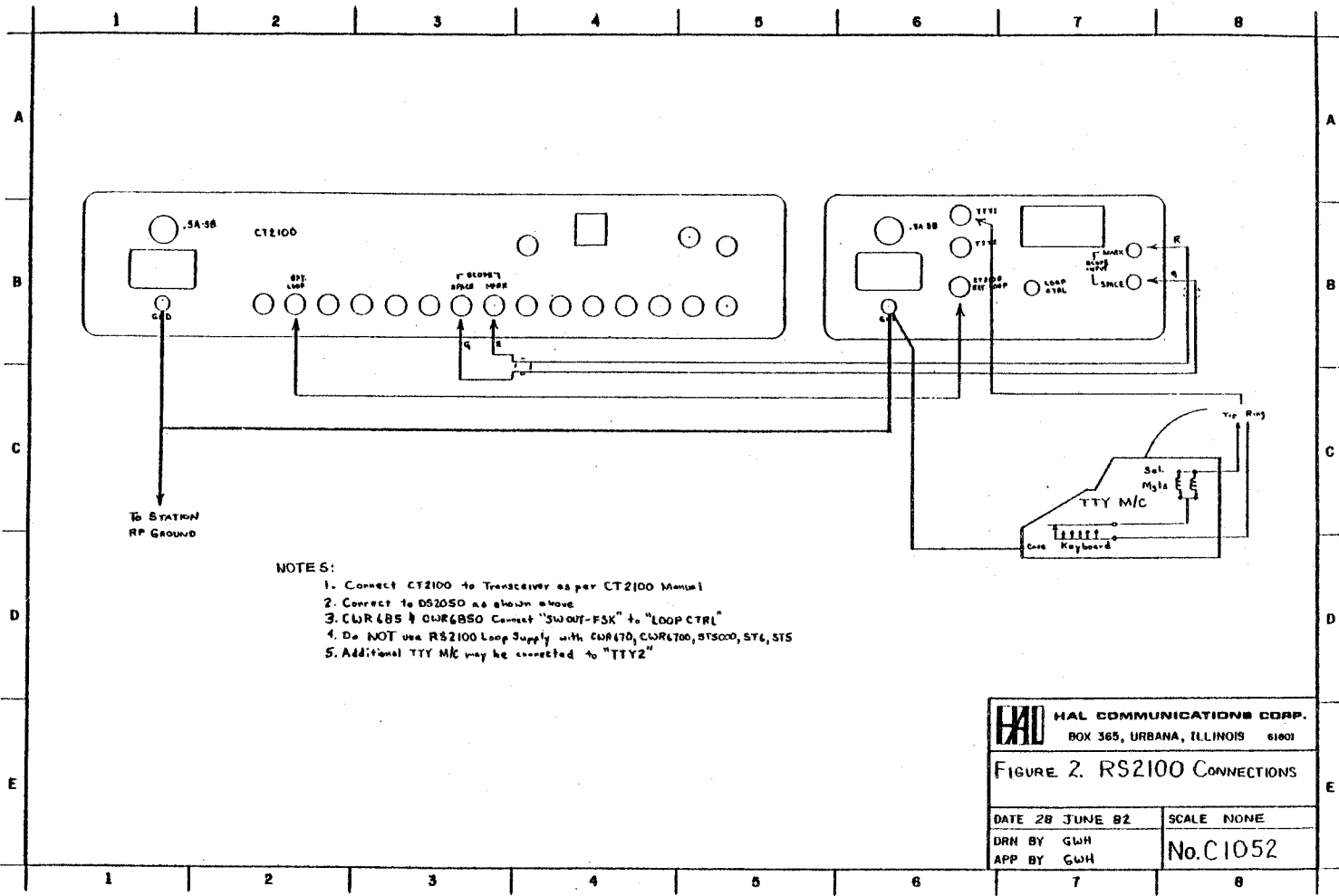
CHAPTER 1

UNPACKING AND INSPECTION

When you unpack your RS2100 carefully inspect the shipping carton and
the cabinet for shipping damage. Any evidence of shipping damage
should be immediately reported to your supplying dealer or shipping
carrier.   Be sure to save all packing materials if damage is found -
the shipping carrier will want to inspect them for any insurance
claim.   Before discarding the packing materials check that all parts
and accessories are accounted for. Check the accessories against the
following list.   If any are found missing, double-check the packing
for loose parts and then notify either your dealer or HAL Communica-
tions Corp. of the shortage. Please specify the HAL part number!

Accessory parts:

         Accessories Packed With RS2100:
          3 - 310-35012 Phono Pin Plug
          1 - 310-00010 Monaural Phone Plug
          2 - 310-00020 Stereo Phone Plug
          1 - 770-05001 0.5 Ampere slow-blo fuse
          1 - 333-17250 Power Cord
          1 - 355-13272 Stereo Phono Cable
          1 - 355-14000 Phono to Phone Plug Cable
          1 - 870-02105 RS2100 USER MANUAL

Figure 2.   RS2100 Connections

NOTES:
1. Connect CT2100 to Transceiver as per CT2100 Manual
2. Connect to DS2050 as shown above
3. CWR685 & CWR6850 Connect "SW OUT-FSK" to "LOOP CTRL"
4. Do NOT use RS2100 Loop Supply with CWR670, CWR6700, STS000, ST6, STS
5. Additional TTY M/C may be connected to "TTY2"

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FIGURE 2. RS2100 CONNECTIONS

DATE 28 JUNE 82	SCALE NONE
DRN BY GWH	No. C1052
APP BY GWH	

CHAPTER 2

RECEIVING WITH THE RS2100

2.1 How it Works

The RS2100 is an accessory for the CT2100 Communications Terminal that provides an RTTY oscilloscope tuning indicator and a high voltage RTTY loop power supply. The RS2100 cabinet matches that of the CT2100 and is approximately one-half the width of the CT2100. However, the RS2100 may also be used with a great variety of other models of RTTY equipment, including the HAL DS2050, CWR685, CWR6850, CWR670, CWR6700, ST5000, ST6K, ST5K, and most other brands of RTTY demodulator-terminal equipment on which a tuning scope output is provided. The RS2100 will not provide tuning indication for phase-lock loop types of demodulators or other circuits that do not provide separate filtered outputs for mark and space channels.

The tuning indicator section of the RS2100 uses a 1 inch diameter CRT (Cathode Ray Tube) to present the "standard" crossed-ellipse type of tuning indication. The CRT circuit has separate amplifier stages for both the X (horizontal) axis and the Y (vertical) axis of the display. The standard RTTY connection is to display the RTTY mark signal on the X-axis of the CRT and the space signal on the Y-axis. Controls are provided so that the Gain of both the X and Y axis amplifiers may be adjusted to suit your particular demodulator. These controls are mounted along the top edge of the circuit board and the RS2100 top cover must be removed for their adjustment. As shipped from the factory, these controls are set for proper display when the RS2100 is used with the CT2100.

Four front panel controls are provided for adjustment of the CRT trace intensity ("I"), focus ("F"), vertical position ("V"), and horizontal position ("H"). These four controls are grouped around the CRT bezel. These adjustments should be set to your prefered viewing conditions. An astigmatism adjustment is also mounted on the internal circuit board. This control is set at the factory and should only need re-adjustment if the CRT itself is changed.

The RS2100 also includes a high-voltage loop power supply that allows the CT2100 and DS2050 to key the selector magnets of an RTTY machine (Models 14, 15, 19, and 28 in particular). This supply has an open-loop voltage of 200 VDC and the mark current is set to approximately 60 mA. The loop supply may be keyed directly from a high voltage switch in the terminal, such as is found the the CT2100 and DS2050, or through an optical isolator circuit from low voltage

transistor switches as are used in the CWR685, CWR6850, CWR670, and CWR6700, and various models made by other manufacturers.

Special circuitry in the CT2100 and DS2050 allow transmitting of RTTY from loop connected devices (keyboard or tape transmitter) when the high voltage connection is used. The optically isolated connection may only be used to drive a printer when receiving. Two front panel lamps, labeled "LOOP - M / S", indicate the state of the loop signal. These lamps ONLY indicate the loop status and DO NOT necessarily show the same state as that indicated on the CRT screen. Two isolated, "stereo-type" of phone jacks are provided on the rear panel for connection to RTTY machines.

The internal power supply of the RS2100 provides +/- 500 VDC for the CRT circuitry, +24 VDC for the CRT amplifiers, and +200 VDC @ 60 ma for the loop circuit. The power transformer may be connected for either 110-130 or 220-260 VAC, 50 or 60 Hz. A 0.5 Ampere slo-blo fuse protects the entire unit.

2.2 Connecting the RS2100 Tuning Scope

Please refer to Figure 2., "RS2100 Connections", when connecting the RS2100 to your RTTY equipment. A "stereo-type" of twin phono connection cable is provided for connection of the RS2100 to your demodulator. Use this cable to connect the "MARK" and "SPACE" scope connections of the CT2100 to the RS2100. This cable should also work directly with the DS2050, CWR685, CWR6850, CWR670, and CWR6700. The demodulator end of the cable will have to be modified when the ST5000, ST6K, or ST5K are used; just cut-off this end of the cable and install the Molex pins and shell as described in the demodulator instruction manual. Connect a ground wire between the RS2100, CT2100 (or other demodulator), transceiver, and any RTTY machine cabinets. Also, connect the RS2100 power cord to a grounding type of AC power outlet. Connection of the loop supply will be discussed in section 2.4 of this manual.

The internal X and Y axis amplifiers of the RS2100 are set at the factory for the correct gains for use with the CT2100. Other terminals may require additional adjustment. The DS2050 and ST5000 should operate with similar gain settings to those set for the CT2100. The gain controls will probably require re-adjustment (increased gain) when other models are used. The gain control potentiometers are mounted on the left end of the RS2100 circuit board (viewed from the front panel) and the RS2100 cabinet top will have to be removed to make the adjustments (remove top three screws on each side). These controls are most easily set when RTTY stations are received as will be discussed in the following section.

```
**********************************************************
*                                                        *
*    C A U T I O N ! !                                   *
*    Potentially lethal voltages are exposed  when       *
*    the top cover is removed from the RS2100. Use       *
*    extreme care when the RS2100 is operated with       *
*    the top cover removed.    Use of an insulated       *
*    alignment screw driver is highly recommended!       *
*                                                        *
**********************************************************
```

2.3 Receiving RTTY Signals

Turn on the ac power to the RS2100 and the CT2100 (or other RTTY demo-
dulator).   Tune the receiver to a RTTY station and adjust the CRT in-
tensity and focus controls to obtain a viewable trace. These controls
will interact, so a "two-handed" adjustment procedure is recommended.
Do not try to set too high a trace intensity as this causes severe de-
focusing!   Position the traces to the center of the CRT screen. For
the CT2100, DS2050, and ST5000, these should be the only adjustments
you need to make.

For other models, you may now have to adjust the X and Y axis gain
controls to obtain sufficient CRT trace deflection. As noted in the
previous section, these adjustments are located inside the RS2100 on
the circuit board and the top cover must be removed for access to the
controls. Be sure to use the insulated alignment tool and avoid con-
tacting any part of the RS2100 interior as POTENTIALLY LETHAL voltages
are exposed when the cover is removed. Adjust the two left-hand po-
tentiometers (viewed from front) for an approximate 2/3 width screen
deflection in both X and Y directions (left pot = Y axis, center pot =
X axis).   Do NOT attempt to set the gain for full, edge-to-edge CRT
deflection as severe trace distortion will occur. The traces may be
most easily adjusted when a 850 Hz shift RTTY signal is received.
Conversely, the receiver may be tuned to a constant carrier such as
the crystal calibrator to give separate mark and space conditions.

The traces displayed will NOT be crossed lines unless very narrow
bandwidth mark and space filters are used in the demodulator. The
normal display with all HAL models will be the crossed-ellipse pat-
tern. The tuning oscilloscope output of most demodulators is obtained
from the demodulator discriminator filters. These filters are pur-
posely designed for a fairly wide bandwidth to assure that all of the
keying sidebands of the RTTY signal are properly detected and the op-
timum signal-to-noise ratio is preserved. The wide bandwidth of the
discriminator filter allows some of the space signal to be detected in

the mark filter and vice-versa. For example, if only a mark tone is received, a high-amplitude signal will be present at the mark discriminator filter. However, a small amount of the mark tone will also be present at the space filter because of its wide bandwidth. Therefore, a signal is presented to both the X and Y axis of the RS2100 scope; a large amplitude signal on the X-axis and a smaller amplitude signal on the Y-axis. What you see on the CRT is therefore an open ellipse. Correct tuning is shown by a maximum CRT deflection on the MAJOR axis (X for mark and Y for space). Since the bandwidth of the discriminator filters depends upon the data rate (WPM or baud) to be received, the ellipse will be narrow for wide shifts (850Hz) and wide for narrow shifts (170Hz). The wide ellipses obtained with 170Hz shift in particular may be at first confusing, but are easily interpreted with some practice. This wide-ellipse display is actually an advantage in that a degree of phase information is also shown by the CRT and, with practice, you can determine which direction the receiver dial should be turned to obtain correct tuning.

If you prefer the crossed-line type of display, this may be obtained by adding separate high-Q filters tuned to mark and space between the demodulator and RS2100. However, be careful to use isolation amplifiers between the demodulator and the filter to avoid interaction with the demodulator discriminator filters. Also, these extra filters will have to be tuned very accurately to match the center frequencies of the demodulator filters. The RS2100 will now indicate only when a good frequency match is obtained with respect to the add-on filters, not necessarily the same frequencies as those of the discriminator filters.

Practice tuning-in various RTTY signals, comparing the RS2100 scope trace to the tuning bar and flashing LEDs of the CT2100 (or meter on the DS2050 and ST5000). After some practice, you will find that you can easily set your receiver to within 5 or 10 Hz of the other station's frequency (170Hz shift). If you use a transceiver that truely transmits and receives on the same frequency (correctly aligned), your transmit frequency should now closely match that of the other station, thus eliminating the offset frequency error common with transceiver RTTY stations that do not have an accurate tuning indicator (so-called "frequency walking").

2.4 Connecting the RS2100 Loop Supply

Again, refer to Figure 2., "RS2100 Connections", for connection of the
RS2100 loop circuit to your RTTY equipment. The RS2100 includes a
high voltage (200 VDC open circuit) loop power supply that is pread-
justed for a mark (closed circuit) loop current of approximately 60
ma. This loop supply is identical to that used in the HAL ST6000,
ST5000, ST6, and ST5 demodulators. The RS2100 loop supply is designed
to directly drive the selector magnets of the popular models 14, 15,
19, and 28 teleprinter machines. The RS2100 will NOT directly drive
the selector magnets of the newer models 32 and 33 machines since
these machines use a 500 ma, low voltage selector magnet. Some of the
model 32 and 33 machines do have high voltage loop compatible selector
magnet driver circuits that may be used. However, the model 32 and 33
machines have also been sold with RS232 and TTL data I/O interfaces
which may be damaged by connection to the RS2100's high voltage loop
supply. The owner of such a machine should determine the compatibili-
ty of his particular machine before connecting it to the RS2100.

The simplest loop connection is to just a printer such as the model 15
or 28. In this case, connect the tip and ring terminals of a "stereo"
phone plug (furnished with RS2100 accessories) to the two terminals of
the machine's selector magnets. DO NOT GROUND either of these wires
or the loop keying circuit of the CT2100 and RS2100 will not work.
This connection will allow you to print received RTTY text but does
not allow transmitting from the RTTY machine's keyboard or from a tape
transmitter in the loop circuit. Plug the "stereo" phone plug into
the "TTY1" RS2100 rear panel connector. The "TTY1" and "TTY2" connec-
tors are wired so that EITHER a stereo or monaural type of phone plug
may be used; the "sleeve" connection to these jacks is NOT grounded!
If your TTY machine has a standard 1/4" phone plug, just plug it into
either "TTY1" or "TTY2".

NOTE:
    Loop connection of a printer to the CT2100 or DS2050 with the
    RS2100 only allows you to print a RTTY signal whose code and data
    rate ("speed") match that of the received signal. For example, a
    60 wpm model 15 can only be used to print RTTY signals that are
    using the Baudot code and are running 60 wpm (the usual radio am-
    ateur combination). The loop connection does NOT provide any
    code or speed conversion to the printer; reception of an ASCII
    station or a Baudot station operating at a different speed will
    not give correct print-out on the loop printer. The ASCII
    printer output of the CT2100 does give the code and speed conver-
    sion for Baudot, ASCII, and Morse code signals.

It may also be desireable to use the transmit features of a TTY ma-
chine. This is easily accomplished by just connecting the transmit
contacts of the machine IN SERIES with the selector magnets. For ex-

ample, for a model 15 or 28, just connect the keyboard contacts and
selector magnets in series, as is shown in Figure 2. A tape
transmitter ("TD") may also be connected in series with the loop cir-
cuit to allow transmission of paper RTTY tapes. If the TD is a separ-
ate unit from the teleprinter, the TTY2 jack may be used for its con-
nection as is shown in Figure 2. If you are using a model 19 or model
28 ASR machine, the connection of the TD contacts is usually made
through the table or cabinet wiring and only one loop connection is
usually required for the system.

NOTE:
    ONLY the CT2100 and DS2050 have the internal circuitry necessary
    to sense that the loop circuit has been keyed from an external
    device. The sensed loop signal is then used to key the internal
    transmit tone generator of the CT2100 or DS2050. Other "loop
    output circuits" on equipment of other manufacturers will only
    drive a receive printer. To transmit data from a loop-connected
    device with the CT2100, you must use the "LOOP" position of the
    "NORM-LOOP" switch (button out). Be sure to restore the switch
    to "NORM" when you have completed the loop transmission. On the
    DS2050, engage the "LOCAL" position of the "LINE-LOCAL" switch
    (button out) while transmitting from the loop circuit. Again, be
    sure to restore the switch to the "LINE" position when ready to
    receive.

Connect the RS2100 "CT2100 EXT. LOOP" jack to the CT2100 "EXT. LOOP"
jack with the phono to phone plug cable provided. NOTE: BE SURE THAT
THE RS2100 POWER IS TURNED OFF WHEN CONNECTING THIS CABLE; DO NOT
DISCONNECT THE CABLE FROM THE CT2100 WHEN POWER IS APPLIED TO THE
RS2100 - THERE IS 200VDC ACROSS THE PHONO END OF THE CABLE!

The RS2100 loop supply may also be used with terminals that do not
have a high voltage loop keying transistor such as the HAL CWR685, and
CWR6850 as well as most equipment made by other manufacturers. For
this equipment, use the "LOOP CTRL" input (small phono connector in
the middle of the rear panel). The keying transistor in the driving
terminal should have the characteristic that it is open circuit for
mark condition and closed (transistor "on") for the space condition.
Use the "TTL I/O" output on the CWR685 or CWR6850. The "LOOP CTRL"
input drives an optical isolator in the RS2100 loop circuit; the key-
ing transistor in the terminal need not be capable of switching of a
high voltage or current. The machine connections to the loop in the
case are the same as those outlined above. Note, however, that this
connection may ONLY be used to print received signals. Keyboards or
tape transmitters in the loop circuit are not sensed with the isolator
circuit and the terminal's transmit tones will not be keyed with this
connection. Do not use the RS2100 loop supply with the ST5000, ST6,
or ST5 as these units already include a built-in loop power supply.

CHAPTER 3

IN CASE OF DIFFICULTY

This section of your user's manual will discuss in general terms how
to keep your RS2100 in top operating condition and typical operating
problems you might encounter (and some solutions).

3.1 Care and Feeding of Your RS2100

Your RS2100 is the latest of many generations of RTTY equipment sold
by HAL Communications. In every way, it has been designed, construct-
ed, and tested to assure years of trouble-free operation. However,
there are a number of simple procedures that you, the user, can follow
to further improve the reliability, performance, and lifetime of the
terminal. The following suggestions are offered to help preserve a
long operating life for your RS2100.

Environment:

Electronic equipment is very susceptible to variations in temperature,
relative humidity, and to dust and dirt accumulations. The RS2100
will operate in normal room-temperature environments and should be as
tolerant of temperature extremes as you are while operating it.
However, inadvertent blockage of the ventilating holes in the cabinet
will cause the INTERNAL temperature of the unit to rise considerably
above the ambient room temperature and may in fact cause circuit fai-
lure. Also, accumulations of dust or dirt, particularly when accom-
panied by high humidity conditions, can also cause overheating and may
result in long-term corrosion of the internal circuitry. Therefore,
try to position the RS2100 so that its ventilating holes are not ob-
structed and try to avoid extremely dusty or dirty environments. On
the other hand, the solid-state components in the RS2100 are designed
to operate at considerably higher temperatures than we humans; do not
be overly disturbed if the cabinet of the RS2100 operates quite warm
to the touch. This internal heat often helps to "dry-out" humidity in
the cabinet.

In the normal course of operation, the face of the CRT may attract a
build-up of dust or smoke "haze". This may be expected even in the
cleanest areas, particularly if tobacco smoking is prevalent. Because
of the air flow around the CRT and the high voltage applied to it,
dust is actually attracted to the CRT. This causes, over a period of
time, what may appear to be a gradual fading of the screen intensity
as well as de-focusing of the traces. Therefore, the face of the CRT
should be cleaned often.

Electrical Connection:

All electrical connection points of the RS2100 have maximum voltage
and current ratings as given in this manual. If these ratings are ex-

ceeded for even a short period of time, considerable damage to the
scope may result. Therefore, be very careful -- KNOW the ratings of
the RS2100 and the characteristics of any other equipment before mak-
ing connections. Some common causes of electrical failures have been
found to be:

A. Inadequate grounding, causing RF interference problems as well as
    sensitivity to AC power line transients.

B. Damage from lightning, or other transients on the power line or
    station antenna system. A good lightning protection system may
    help, as will disconnecting the antenna and ac power during
    electrical storms. However, such things are unpredictable and the
    RS2100 is no more susceptible to such problems than other elec-
    tronic equipment in the station.

C. Improper connections to high voltage devices or to equipment with
    inadequate safety grounds. Be sure that all devices plugged into
    the AC mains have safety grounds attached to them. AC line
    by-pass capacitors in a piece of equipment may cause the cabinet
    of that equipment to "float" at an AC potential sufficiently high
    that damage might be done to the RS2100 when the equipment is con-
    nected. CONNECT THE GROUNDS FIRST - THEN CONNECT TO POWER!

3.2 Typical Operational Problems

Operation of the RS2100 should be fairly straightforward and few prob-
lems should be expected. However, there are some indications that may
at first be confusing to the first-time user. The most common of
these are:

1. CRT trace is ovals, not lines:
    As explained in section 2.3 of this manual, this is normal
    since the discriminator filters of most demodulators are ne-
    cessarily wide to accomodate the keying sidebands of the RTTY
    signal. Additional filters may be added between the demodu-
    lator and RS2100 to give sharp line traces, but this is NOT
    recommended since the RS2100 then only indicates the signal's
    match to these filters rather than to the demodulator filters
    as desired.

2. CRT trace is not focused:
    This is usually caused by adjustment of too high an intensity
    control setting. Reduce the intensity control and try re-
    focusing the trace. In extreme cases, the astigmatisim con-
    trol (mounted on the circuit board - see section 3.4) may
    have to be readjusted. If these steps fail, check the CRT
    high voltages.

3. CRT trace distorts at the ends:
    This is usually caused by setting of too high a X or Y axis
    gain.   See section 2.3 and 3.4 to readjust these internal
    controls. If this fails, the amplifier transistors may be
    defective.

4. CRT trace leaves a dot on the screen while transmitting:
    This is entirely normal; the CRT trace is NOT blanked during
    transmission.   Our experience has shown few problems with
    "burning a hole" in the CRT screen due to this dot, especial-
    ly if the CRT intensity is set to a fairly low level as is
    recommended. If you are going to leave the station unattend-
    ed for a period of time, you may wish to turn the intensity
    control down.

5. Mark and Space lights don't flash:
    The mark and space lights indicate ONLY the loop status;
    they do not indicate the same conditions as the CRT! If the
    mark and space lights are not flashing, the loop circuit is
    probably not being keyed as described in section 2.4 of this
    manual.

6. Can't transmit RTTY from the machine keyboard:
    As discussed in section 2.4, loop data can only be transmit-
    ted when the HAL CT2100 and DS2050 terminals are used. This
    is because special loop sensing circuits are built into these
    models that may NOT be included in other pieces of equipment.

3.3 Repair Procedures

In the event that your RS2100 develops a malfunction, the first step
is to carefully note all of the symptoms of the problem. Statements
such as "BROKEN" or "DOESN'T WORK" are of little help to the service
technician, and usually lead to longer repair times than might other-
wise be required. Try to provide as much information concerning the
failure as you can before you contact your dealer. By all means, con-
sult your dealer before calling the factory; he may be able to fix
the unit locally and avoid the shipping and delay times.

The following are some of the things that will concern the dealer or factory:

1. Model number
2. Serial number
3. How long have you owned it?
4. Where did you purchase it (dealer's name)?
5. If purchased used, who was the previous owner? (Used to refer to any previous repair history on that unit.)
6. What operating conditions are associated with the failure?
7. Are there extenuating circumstances? (Lightning, spilled liquids, dropped unit?)
8. What unit are you using the RS2100 with (CT2100, DS2050, etc)?
9. Is there anything else you can add to the description that you think might be useful?

AFTER you have determined answers to the above, contact your dealer and discuss the problem with him. If he indicates that he will be unable to assist you, the unit should be returned to the HAL factory for repair. Before returning the unit to the factory, either you or the dealer should call and receive factory return authorization so that we may expect the unit in shipping and be prepared to work on it when it arrives. Whenever possible, return the unit via UPS to the factory address below, insuring it for the full value. The shipping cost to the factory should be paid by you; the return shipping costs from the factory (48 contiguous states only) are paid by HAL (warranty repairs only). The factory "ship-to" address is:

        HAL COMMUNICATIONS CORP
        1201 W. KENYON ROAD
        BOX 365
        URBANA, ILLINOIS 61801
        ATTENTION: REPAIR DEPARTMENT

The one-year limited warranty (listed in full at the end of this manual) provides for repair of the RS2100 for a full year after purchase. The purchase invoice date from your dealer marks the beginning of the warranty period - save your copy of the invoice! Please read the warranty carefully to determine the full extent of the privileges and limitations.

Figure 3. RS2100 Schematic Diagram

Figure 4. Test Points and User-adjustable Controls

TOP VIEW

X-AXIS GAIN

Y-AXIS GAIN

AST16

+500 HV

CRT

GND

2150/20W

-LOOP HV

A1176

-500V CRT HV

+500V CRT HV

-LOOP HV
(LOOP CLOSED-CKT)

GND

2150/20W

CRT

+24V LV

1000µ/25V

+ LOOP HV
(LOOP OPEN-CKT)

RS2100 CIRCUIT BOARD
(VIEWED FROM FRONT PANEL)

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FIGURE 4. Test Points and User-
adjustable Controls

DATE 28-JUNE-82	SCALE NONE
DRN BY GWH	No. C1053
APP BY GWH	
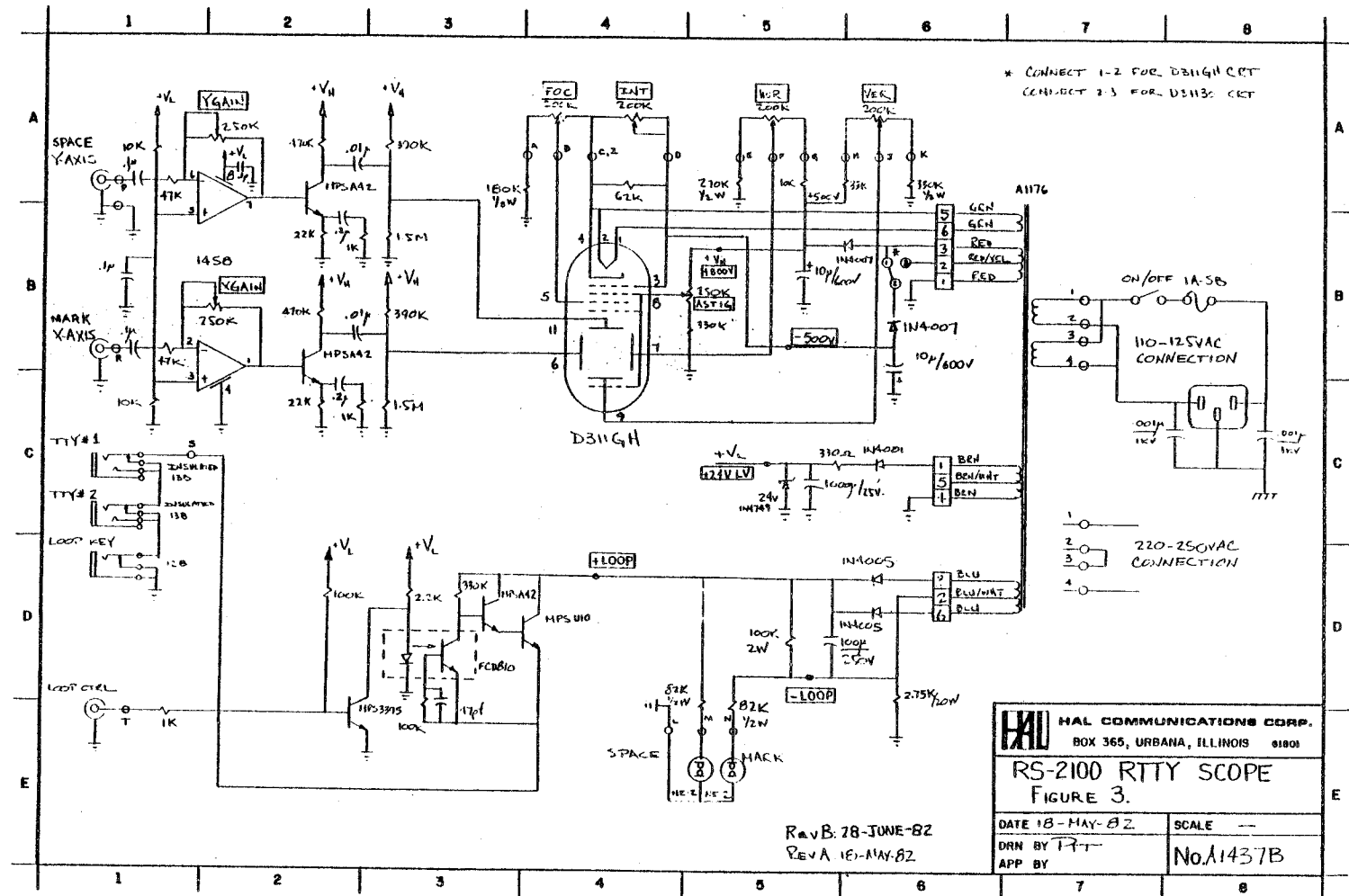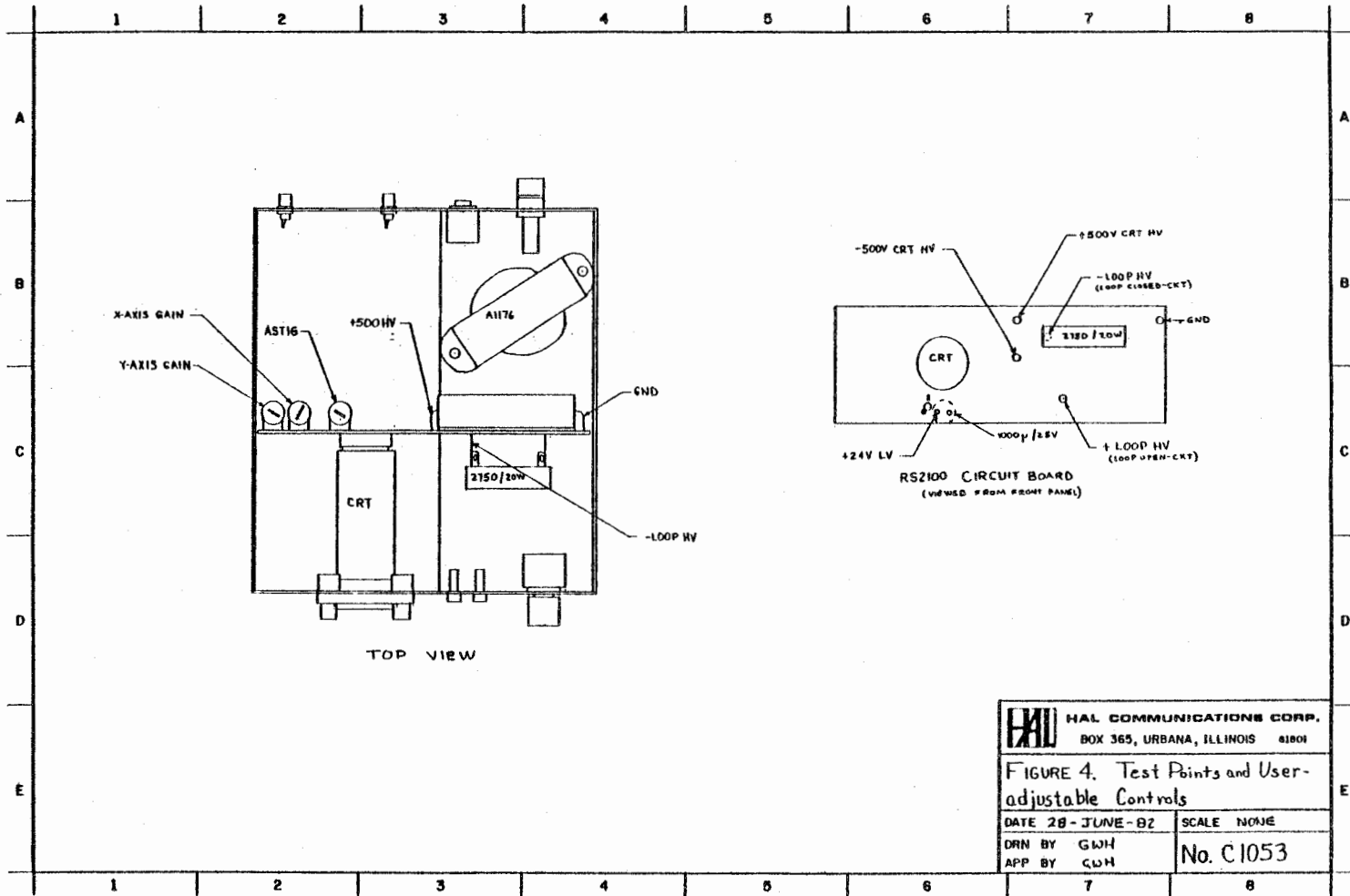
3.4 User Adjustments

Refer to the Figures 3 and 4 for the RS2100 schematic diagram and ad-
justment and test point locations.

```
**************************************************************
*                                                            *
*   C A U T I O N ! !                                         *
*                                                            *
*   Potentially  lethal  voltages are exposed when           *
*   the  protective  covers  are removed from  the           *
*   RS2100.   Be extremely careful when making any           *
*   adjustments  or  tests to avoid  touching  any           *
*   connections  on  the circuit board  or  RS2100           *
*   components.  Use insulated alignment tools for           *
*   adjustments and well insulated test probes for           *
*   all measurements.   Be sure to disconnect  the           *
*   AC power whenever you are removing the  covers           *
*   or changing components in the RS2100.                    *
*                                                            *
**************************************************************
```


There are three internal user adjustments available on the RS2100;
X-axis amplifier gain, Y-axis amplifier gain, and astigmatisim correc-
tion. The adjustmemnt of the X and Y-axis gain controls was discussed
in section 2.3 of this manual. The astigmatism control should be ad-
justed in conjunction with the focus (F) front panel control to give
the most consistent trace focusing over the screen area. This is most
easily accomplished while receiving a RTTY signal. The focus and as-
tigmatism control interact and some back-and-forth adjustment of each
will be nescessary. Be sure to keep the trace intensity fairly low
during this adjustment. The astigmatism control is set at the factory
and should not require readjustment unless the CRT itself is replaced.

As noted in Figures 3 and 4, there are four different power suplies in
the RS2100. If power supply problems are suspected, these voltages
may be checked at the points shown in Figure 4 with a 20,000
ohms-per-volt VOM or higher impedance voltmeter. The voltages should
measure as follows:

```
     +500V CRT HV:   +525VDC +/- 10%
     -500V CRT HV:   -525VDC +/- 10%
         +24V LV:    +24VDC +/-  5%
        +LOOP HV:   +200VDC +/- 10% (LOOP OPEN - "SPACE")
        -LOOP HV:   +180VDC +/- 10% (LOOP SHORT - "MARK")
```


If any of these voltages are not within the above tolerances, a defec-
tive filter capacitor or rectifier diode should be suspected. If all
of the voltages are wrong, the line voltage may be low or high or the
selector taps on the power transformer primary may set for the wrong
voltage. Unless otherwise specified, RS2100's sold within the United
States will have the primary taps set for 110-130 VAC power mains;

export units will be set for 220-260 VAC operation and a special label
will so indicate on the RS2100 rear panel.

The cathode ray tube used in the RS2100 is a long-lifetime device and
it is unlikely that it will fail until after many years of service.
When CRT replacement is required, be sure to disconnect the power and
then gently pry the CRT out of the tube socket with a small blade
screw driver. The CRT can then be pulled out through the front bezel.
When installing the new CRT, be sure that the tube pins are all stra-
ight and aligned with the socket holes. The "gap" between pins 1 and
13 is near the top of the socket. Before pressing the tube into the
socket, make sure that all 13 pins are correctly positioned with res-
pect to the socket pins. It is easiest to stand the RS2100 vertically
on its back when positioning the CRT for insertion. Now, gently press
the CRT into the socket. There may be some variation in the CRT phy-
sical length between tubes; this can be compensated for by the amount
of insertion into the socket.

These are the ONLY user adjustments and tests on the RS2100.   If you
are unable to correct a fault after making these tests, the unit
should be returned to HAL Communications Corp. as explained in sec-
tion 3.3 of this manual.

CHAPTER 4
SPECIFICATIONS

RTTY SCOPE INPUT:

    Sensitivity: Approximately 10v/in to 100v/in (adjustable)

    Impedance: 47K ohms

    Connectors: Separate phono connections for mark (X-axis) and space (Y-axis) input.

RTTY SCOPE CONTROLS:

    Front Panel: Horizontal Position (H)
                         Vertical Position (V)
                         Focus (F)
                         Intensity (I)
                         AC Power (ON-OFF)

    Internal: X-axis gain (X)
                         Y-axis gain (Y)
                         Astigmatisim (ASTIG)

RTTY SCOPE CRT: 1 inch diameter, green phosphor

LOOP SUPPLY:

    Open Circuit: 200 VDC, nominal (space condition)
    Closed Circuit: 60 ma, nominal (mark condition)

    CT2100 Loop Key: Direct high voltage switch in loop circuit ground return. May be used with CT2100 and DS2050 to receive and transmit to/from loop connected devices.

    LOOP CTRL Key: Optically isolated switching circuit. Requires open-circuit for mark condition and short-circuit for space (external switch transistor "on"). May be used with CWR685, CWR6850 and units of non-HAL manufacture to print received signals (use "TTL I/O" output on CWR685 and CWR6850). Does NOT permit transmitting from loop devices.

    LOOP Outputs: Two three conductor ("stereo") phone jacks wired to accept either stereo or monaural plugs. TTY machine connections must be isolated from ground return.

MECHANICAL
SPECIFICATIONS:

     SIZE: 8.25"W x 3.5"H x 10.156"D
                    21.0cm x 8.9cm x 25.8cm
                    Color: Light gray cover and black front panel

     WEIGHTS: 9.0 lbs net,   12 lbs shipping
                    4.1 kg net,   5.5 kg shipping

     POWER: 120 or 240 vac, 50/60 Hz
                    18 Watts

LIMITED WARRANTY

HAL Communications Corp. of Urbana, Illinois, hereby warrants to the original retail purchaser only that the product herein described and sold shall be free from defects in materials and workmanship for a period of one year from the date of sale to the original retail purchaser.

In the event of a defect in materials or workmanship during the warranty period, HAL Communications Corp. will, at its own expense, repair the defective unit and replace any defective parts. Cost of shipping the unit to HAL Communications Corp. as well as costs of removal and reinstallation of the unit shall be paid by the purchaser. HAL Communications Corp. will bear the shipping costs incurred in returning the unit to the purchaser (48 contiguous states only).

To obtain service under this warranty, the original purchaser should do the following:

1. Notify, as soon as possible, the Customer Service Department of the original selling dealer or HAL Communications Corp., Box 365, Urbana, Illinois, 61801, either in writing or by telephone, of the existence of a possible defect.
2. At the time of notification, identify the model and serial number, date of purchase, place of purchase, and the possible defect.
3. Hold the unit until a written return authorization is received.
4. Return the unit, freight prepaid, upon the receipt of the written return authorization with a copy of the original bill of sale for the equipment.

Correct installation, use, maintenance, and repair are essential for proper performance of this product. The purchaser should carefully read the technical manual.

This warranty does not apply to any defect which HAL Communications Corp. determines is due to any of the following:

1. Improper maintenance or repair, including the installation of parts or accessories that do not conform to the quality and specifications of the original parts;
2. Misuse, abuse, neglect, improper installation, or improper operation (including operation without a proper safety ground connection);
3. Accidental or intentional damage.

All implied warranties, if any, are limited in duration to a period of
one year from the date of purchase by the original retail purchaser.
(Some states do not allow limitations on how long an implied warranty
lasts, so the above limitation may not apply to you.)

HAL Communications Corp. disclaims any liability for incidental or
consequential damages arising out of the use of, or inability to use,
this product. (Some states do not allow the exclusion or limitation
of incidental or consequential damages, so the above limitation or ex-
clusion may not apply to you.)

This warranty gives you specific legal rights, and you may also have
other rights which vary from state to state.