

SIROTEM 3 Synchronised Receiver
and
Stand Alone Transmitter (SATX-1)
Operator's Manual

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Alone Transmitter (SATX-1) Operator's Manual

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IMPORTANT WARNINGS

1. For the SATX-1 Medium Power Transmitter, please note that the high voltage loop supply is not switched by the front panel power switch. Accordingly loop supply voltage is present on the switching module and circuit boards whenever the main power connector is inserted.

No voltage will be present at the loop output connector when the power switch is in the OFF position.

The auxiliary power connector allows power to be applied only to the synchronisation circuitry and oscillator in SATX-1. This supply is not switched by the front panel power switch and is applied as soon as a power source is connected to the auxiliary power connector.

THUS :

Remove all power connectors from the unit during dis-assembly from case and removal or insertion of any printed circuit boards or internal connectors.

2. Read this manual carefully and especially Section 2.3 on power supplies before attempting to apply power to SATX-1.
3. The lid of SATX-1 must be kept in the open position during operation to permit adequate heat dissipation.

The lid heatsink and case front will heat significantly and should be kept clear to allow free air circulation.

1. GENERAL INFORMATION

1.1 Introduction

This manual is designed to familiarise users with the operational characteristics and procedures for SIROTEM equipment fitted with synchronisation facilities and/or medium power transmitter. It is applicable to the following equipment models.

(i) SIROTEM 3 TYPES MS & MMS

"S" denotes a unit fitted with synchronisation facilities. SIROTEM will have been either bought with these facilities already installed or upgraded from a type M or MM

(ii) Stand Alone Transmitter (SATX-1)

This contains synchronisation facilities, a medium power transmitter and system monitoring facilities.

It should be noted that the SATX-1 has been designed to operate also with SIROTEM MKII and that not all facilities provided are relevant to SIROTEM 3. A separate manual is available which describes the operation of the SATX-1 with SIROTEM MKII (Part No. 9550-00-0027).

1.2 Description

1.2.1 Synchronisation Facility

The function of this facility is to allow a SIROTEM receiver and transmitter to operate physically separated without the need for a hard-wired connection between them. Situations where this is of advantage include :-

- (i) RVR-1E Roving Vector Receiver in Turam Mode with a large fixed transmitter loop.

In this situation large distances need to be traversed with RVR-1E. By eliminating the need for a long signal cable back to the SIROTEM unit, the synchronisation facility improves,

- production rate (no cable shifting)
- data quality (no cable noise or signal loss)
- system reliability (no cable breakages).

- (ii) DHR-1 Drill-Hole Receiver with a physically separated transmitter loop.

Previously, in this case, an operator must be present to shift the receiver in the hole with another to operate SIROTEM (or one must lose time travelling back and forth). Use of the synchronisation facility renders this a one man operation without sacrificing production rate or loop current.

To operate in synchronised mode a transmitter and receiver both fitted with synch. circuitry are required. The receiver must be a SIROTEM 3 model MS or MMS while the transmitter must be a SATX-1.

Synchronisation between receiver and transmitter is maintained by a highly stable crystal oscillator in each unit and drift rates of less than one micro-sec. per hour are typically achievable. The crystals are isolated from changes in ambient temperature by ovens. Warm-up time is of the order of ten minutes from cold and operation can commence at this time with a pair of properly adjusted oscillators. Even better drift rates are achievable if power is supplied to the oscillators during equipment storage and transport to the field.

1.2.1 Synchronisation Facility (cont)

This can be done for SATX-1 by connecting the auxiliary power connector to the Sirotem 3 external battery pack by means of the supplied cable. Sirotem 3 models MS and MMS can be operated from the additional batteries provided in the lid of the console.

Synchronisation is acquired by transfer of timing information from one unit to another. This transfer is achieved in one of two ways.

- (i) via a cable connected from one to the other for the synchronising process
- (ii) by placing RVR-1E and receiver adjacent to the transmitter loop and sensing the primary transmitter field.

The SATX-1 transmitter unit provides the synch. information to the receiver thus acting as the master. Loop current information for normalisation is read from the SATX-1 and keyed in to the Sirotem 3 using the Data Acquisition menu.

1.2.2 Medium Power Transmitter (MPTX)

All SATX-1 units are fitted with medium power transmitters as standard equipment providing 20A, 100V maximum switching capability.

The greater power handling capability of this transmitter can be used to drive larger loops with higher currents without the need for heavy loop wire. Any loop supply voltage from 24V to 100V can be employed. The voltage is generally selected to achieve as near maximum rated current as possible with the particular loop in use.

Batteries or a low ripple D.C. power supply are suitable for the MPTX as detailed in Section 2.3.

1.2.3 SATX-1 Monitoring Facilities

A number of system operational parameters can be monitored with SATX-1, displayed by its two liquid crystal displays.

- Duration of transmitter current turn-off,
- Transmitter "off-time" (equals "on-time"),
- Elapsed time,
- Supply voltages,
- Loop current,
- Drift rate between two oscillators.

2. OPERATION

2.1 Front Panel Control Functions

The functions of all SATX-1 controls are described here. Numbers shown in brackets refer to the location numbers on the front panel illustration on p. 27.

Step by step operational procedures can be found in Section 2.4 of this manual.

(1) Power ON/OFF

Power is supplied to the instrument electronics from the main power connector when this switch is in the "ON" position. Please note that this switch controls only the power to the instrumentation section of the unit and does not switch the high voltage loop supply or auxiliary supply. (Refer "Important Warnings" page 1).

(2) Synch. Mode

This rotary switch controls the synchronisation functions and has four positions.

OFF - This position is not required for operation with SiroteM 3.

CABLE - The transmitter is disabled in this position.
(Selected also when synchronisation is to be acquired from SiroteM MK II via a cable connected to the "synch. IN/OUT" BNC connector (5). ie the unit acts as a slave and receives synchronisation information from another unit functioning as master.)

2.1 Front Panel Control Functions (cont)

LOCK - Selected during the data collection process. If the "CABLE" position was selected prior to "LOCK", the unit will not transmit.

If the "TX" position was selected prior to "LOCK", the unit will transmit.

When the "LOCK" position is selected the "RESET" button is disabled to avoid accidental reset of the synch. circuitry and resultant loss of synch.

TX - Selected when a unit is to provide synchronisation information via the "synch. IN/OUT" connector (5) functioning as an output. The unit's transmitter is also enabled in this mode.

(3) Reset

Pressing this button resets the synchronisation clock circuitry and returns the unit to a quiescent state. This control is disabled while the "synch. mode" switch (2) is in the LOCK position.

(4) Synch.

A green LED indicator flashes whenever the unit is functioning in the synchronised mode either as a master or slave. It flashes at the same rate as positive transmitter pulses.

2.1 Front Panel Control Functions (cont)

(5) Synch. IN/OUT

A connector acting as an output in "TX" mode providing synch. information as a master. (The connector can also be used as an input in "CABLE" mode when SATX-1 acts as a slave to a SIROTEM MKII as master.)

(6) Channels

A thumbwheel switch selecting the number of data acquisition channels. The SiroteM 3 must have appropriate selections for its Final Window and number of 10 or 8.33 ms acquisition periods in order to acquire synch. correctly. Refer to section 2.4 for further information.

(7) TX+

A red LED indicator which flashes when the unit is in TX mode. It flashes in synchronism with positive TX pulses when the unit is actually transmitting.

(8) Initiate (INIT)

A toggle switch which initiates the synchronisation process in accordance with the synch. mode in operation.

(9) Fuses

HV - a fuse for each side of the HV loop supply (15A 3AG).

LV - instrument electronics supply (0.5A 3AG).

AUX - auxiliary supply to oscillator and synch. circuitry (0.5A 3AG)

2.1 Front Panel Control Functions (cont)

(10) RX Synch.

Not used in conjunction with SiroteM 3.
(When measuring the synchronisation error between SATX-1 and SIROTEM MK II, a cable is connected between the "synch. IN/OUT" connector of the SiroteM and this BNC input socket. To provide a signal to SATX-1 for measurement, the SiroteM must be transmitting.)

(11) Timing Display

A 3 1/2 digit liquid crystal display used in conjunction with the function selector switch below it (12).

(12) Timing Display Function Switch

A 4 position rotary switch with positions which function as follows.

- "Clock Shift (us)"

Not used in conjunction with SiroteM 3.
(Displays clock synchronisation error between SATX-1 and a SiroteM MK II in units of micro-seconds. "RX Synch." socket must be connected to the "Synch. IN/OUT" socket of another transmitting unit to perform this measurement.)

- "Turn-Off (us)"

Displays duration of loop current turn-off ramp, again in micro-seconds. SATX-1 must be transmitting and, of course, connected to the loop of interest.

- "Off-Time (ms)"

Displays the time period for which the transmitter is off between pulses (equals "On-Time") in milli-seconds. SATX-1 must be transmitting for this measurement.

2.1. Front Panel Control Functions (cont)

- "Elapsed Time (HH-MM)"

Displays the time for which this switch position has been selected in format of hours and minutes as shown. The timer is reset as soon as another switch position has been selected. This feature is useful for keeping track of warm-up time, time since last synchronisation etc.

(13) System Display

A 3 1/2 digit liquid crystal display used in conjunction with the function selector switch below it (14).

(14) System Display Function Switch

A 4 position rotary switch with positions which function as follows.

- "HV"

Displays the HV loop supply voltage applied to SATX-1 via the power connector. The total voltage between positive and negative supplies is displayed. (24V to 100V permissible).

- "TX Curr."

Displays the loop current while SATX-1 is transmitting.

- "LV"

Displays the instrumentation supply voltage applied to the unit. The total voltage between positive and negative supplies is displayed (ie 24V nominally).

2.1. Front Panel Control Functions (cont)

- "Phase"

Displays the phase angle between the SATX-1 internal 1MHz clock and an external 1MHz clock connected to the "1MHz IN" socket. The latter is derived from the SIROTEM 3 which is to be synchronised. Phase angle between -180 degrees and +180 degrees is displayed and provides a very sensitive measurement of oscillator frequency error.

Periodic oscillator frequency adjustments can be performed using the display by setting for minimum rate of change in displayed phase angle. A change in phase angle of 360 degrees (-180 degrees to +180 degrees) corresponds to a timing drift of one micro-second between two units. Very accurate oscillator adjustments can be performed as phase is displayed to a resolution of 0.1 degree.

(15) 1MHz IN

A 1MHz clock signal for phase comparison with the SATX-1 internal clock can be applied via this BNC connector. (Refer 14. "System Display Function Switch").

(16) 1MHz OUT

Not used in conjunction with SiroteM 3. The SATX-1 internal 1 MHz clock is available on this connector.

(17) Oscillator Adjustment

Oscillator electronic adjustment is provided by a ten turn vernier dial.

2.1. Front Panel Control Functions (cont)

(18) Oven

A LED indicator, which when illuminated, warns that the oscillator oven has not reached operating temperature. This LED normally lights after application of main or auxiliary power from cold and extinguishes after five to ten minutes depending on the length of time the unit has been without power.

(19) Test

A "D" series connector providing a variety of internal signals useful for test and troubleshooting purposes. Details are provided in circuit diagrams for SATX-1.

2.2 Cables and Accessories

A number of cables and accessories will have been supplied specifically for use in synchronised mode. Wiring diagrams are included at the end of this manual.

2.2.1 Sync. Cable (Figure 5)

(Coaxial BNC - BNC Connectors)

- To connect between the "synch. IN/OUT" (5) connector of SATX-1 to the "sync" connector of Sirotec 3 for acquisition of synchronisation by the latter.

2.2.2 Phase Cable (Figure 6)

(Coaxial : BNC - "D" Series Connectors)

To connect from the "interface" (23) socket on a SIROTEM 3 to "1MHz IN" (15) connector on a SATX-1 for phase comparison of two units' internal oscillators.

NOTE : Read carefully Section 2.3 concerning power supplies before attempting to apply power to SATX-1.

2.2.3 SATX-1 Battery Power Cable (Figure 7)

(Wired Harness : Lugs - Cannon AP-6 pin Connector)

This cable is used to connect power to SATX-1.

Labelled circular lugs at the free end allow connection to a variety of power supplies.

Seven short link cables are supplied for inter-connection of up to eight batteries if these are to be used as a supply. (Figure 8)

2.2.4 SATX-1 Auxiliary Battery Power Cable (Figure 9)

This cable connects between the SATX-1 auxiliary power socket and the Sirotec 3 external battery box.

2.2.5 SATX-1 - Interface Power Cable (Figure 10)

This cable connects between the generator interface and the SATX.

2.2.6 SATX-1 Loop Cable (Figure 11)

(Cannon - AP-6 pin to "Bullett" Connectors)

This cable connects from the loop output connector of a SATX-1 to the transmitter loop. "Bullett" type connectors are provided at the free end for the loop connection.

2.2.7 RVR Connection Cable (Figure 12)

(Grey Shielded : Cannon AXR-7-11 7 way to AMP RVR Connector)

When using SIROTEM as a receiver in synchronised mode with an RVR-1E, a connection cable is required between these two units. This ten metre cable is plugged between the RVR-1E connector and the SIROTEM MKII loop connector or the SIROTEM 3 adapter cable.

2.2.8 SIROTEM 3 Adapter Cable (Figure 13)

(Cannon CA06COM-E18-1P-B 10 way to AXR7-12 7 way connector)

This cable allows the RVR connection cable to be plugged into a SIROTEM 3 model.

2.3 Power Supplies

2.3.1 SIROTEM 3

SiroteM 3 models MS and MMS which are fitted with synchronisation facilities are provided with an additional set of batteries in the lid of the console. This permits the instrument to be operated as a synchronised slave (not transmitting) without having to carry the external battery box. The lid batteries are provided with a connector which plugs into the power receptacle on the control panel. SiroteM 3 then operates in the normal way. The lid of the console can be closed for easy transport while the unit is operating.

2.3.2 SATX-1

In this case a heavy duty 6 pin main power connector is installed.

All supplies to the unit must be centre tapped providing a 0V connection to the unit. The supplies can be thought of as two separate requirements :

1. A +/-12V supply for the instrument referred to as LV.
2. A +/-HV supply for the switcher for supply to the loop which can be in the range +/-12V to +/-50V. (ie 24V to 100V total loop supply voltage).

Figure 3 illustrates how the supply must be arranged using a bank of batteries for illustration. A SATX-1 power cable will have been supplied. One end connects to the main power connector. The other end consists of five connection lugs labelled and coloured according to their purpose. The cable is physically configured to allow connection to a bank of up to eight batteries in line and seven short link cables are also provided for interconnection between batteries if these are used as the power source.

A "continuous use deep cycle" battery type should only be used rather than standard car batteries.

eg. Exide "Amp Power" Series. Battery chargers with current capacity sufficient for overnight re-charge (ie 10-15A) should be selected.

Figure 3 illustrates a configuration providing approximately +/-48V (96V total) as the HV loop supply with eight batteries. In practice the HV loop supply can be arranged to suit the loop to be used with a view to approaching as near 20A as possible. A bank of six batteries will give +/-36V (72V total) and so on.

eg. A particular loop is known to give 6A loop current with a standard SIROTEM transmitter with +/-12V (24V total) supply. When using a SATX-1 and a battery supply, it is desired to achieve as near 20A loop current as possible for maximum penetration. A +/-36V (72V total) supply would thus be recommended and would yield approximately 18A into this loop.

2.3.2 SATX-1 (cont)

If using mains power supplies they should exhibit low ripple characteristics and good transient response to sudden current changes in view of the switched nature of the SIROTEM waveform. The supply configuration must be the same as that of Figure 3. Figure 4 illustrates a possible configuration which achieves this. The two HV supplies should give the same output voltage.

IMPORTANT

Before connecting a newly configured supply to a SATX-1 **always** check for correct polarity and voltages at the pins of the power cable connector. This check is performed simply as follows with a multimeter.

1. Insert negative probe of multimeter into pin 3 of power connector and connect positive probe to pin 1. 12V should be measured.
 2. Insert positive probe in pin 3 and negative probe in pin 2. 12V should be measured.
 3. Insert negative probe in pin 6 and positive probe in pin 4. The +HV loop supply voltage should be seen.
 4. Insert positive probe in pin 6 and negative probe in pin 5. The -HV loop supply should be seen.
- eg. For a bank of eight batteries, 48V approximately should be seen in steps 3 and 4.

This check is greatly simplified with a digital multimeter which can display both positive and negative voltages.

2.3.3 TX Low Voltage Cut-Off

All units fitted with synchronisation facilities, including SATX-1 and SIROTEMS, are fitted with cut-off circuitry which disables the transmitter once one or both of the transmitters' instrumentation supplies drops below 10V. When using a battery supply, this prevents operation to the point where synchronisation error becomes large due to batteries being too flat to operate.

If a unit will not transmit therefore, always check the supply voltage level. In the case of a Figure 3 configuration, the terminal voltage may drop below 10V on load during a transmitter pulse as batteries are near exhaustion. This will be sufficient to cause TX cut-off even though the off load terminal voltage may be greater than 10V.

To reset the cut-off circuit press "INIT".

2.3.4 TX Over-Current Cut-Off

If the 20A current rating of the transmitter is exceeded, the transmitter cut-off circuit will operate. Once the cause of the excess current has been remedied, the circuit can be reset and the transmitter restarted by pressing "INIT".

2.4 Step by Step Operating Procedures

2.4.1 Field Start-Up Procedure in Synchronised Mode

The following procedure should be followed to commence operating in synchronised mode. It is assumed that a suitable loop and power supply arrangement to give the required loop current has been arrived at as per Section 2.3.

1. Allow the crystal oscillators of both units at least half an hour to warm up and stabilise. The SATX-1 may be operated using an external battery pack connected to the auxiliary power input which automatically powers up the oven.

The SiroteM 3 should be operated with its lid batteries plugged into the power receptacle. Turn the power switch and the oven switch on.

2. After warm up, connect main power to the SATX-1 and turn the unit ON (1). If Auxiliary power was connected, this can now be removed from its socket.

NOTE

If using a generator interface, disconnect SATX before changing HV setting on the interface.

3. Connect the loop to be used to the transmitter using the SATX-1 loop cable (Section 2.2.4).
4. The oscillator drift rate should be checked as per Section 2.4.2 at this point.
5. Set up the SiroteM 3 as follows:
 - (1) From the main menu, select 'Setup & Utilities' then 'Configure Menu'. Ensure that 'Loop Current' is set to 'Manual'. This makes it possible to key in the SATX-1 transmitter loop current for correct data normalization during subsequent runs.
 - (2) Press 'ESCAPE' twice to return to the main menu, then select 'Data Acquisition'. Enter all operating parameters and annotation details as required.

2.4.1 Field Start-Up Procedure in Synchronised Mode (cont)

- (3) Ensure that the Final Window is set to the desired value. Determine the corresponding SATX-1 channel switch setting from the following tables (taking account of the local mains frequency). Set the channels thumbwheel switch (6) on the SATX-1 to this value. Note the corresponding number of 10 or 8.33 msec periods from column 3 of the table.

SYNCHRONISATION AT 50Hz REJECTION

SIROTEM 3 FINAL WINDOW	SET SATX-1 CHANNEL SWITCH TO...	SET SIROTEM 3 10 ms PERIODS TO...
1-22	1-5	1
23-26	6-7	2
27-28	8-9	3
29-31	10 = A	5
32	11 = B	6
33-34	12 = C	8
35	13 = D	10
36-37	14 = E	13
38-39	15 = F	18

SYNCHRONISATION AT 60Hz REJECTION

SIROTEM 3 FINAL WINDOW	SET SATX-1 CHANNEL SWITCH TO...	SET SIROTEM 3 8.33 ms PERIODS TO...
1-21	1-4	1
22-25	5-6	2
26-27	7-8	3
28-29	9	4
30-31	10	6
32	11	7
33	12	9
34-35	13	12
36	14	15
37-38	15	21

2.4.1 Field Start-Up Procedure in Synchronised Mode (cont)

- (4) Press 'ESCAPE' to return to the main menu, select 'Synchronisation' and then press 'ENTER'.
 - (5) The number of 10 or 8.33 msec periods read from the table should then be entered. If the correct number appears at the cursor, simply press 'ENTER'. Otherwise enter the correct number then press 'ENTER'. If necessary, the existing entry can be erased using the 'CLEAR' key.
 - (6) The display then indicates that the instrument is waiting for sync.
6. Connect the synch cable between the SATX-1 'Sync. IN/OUT' connector (5) and the SIROTEM 3 'sync' connector.
 7. On the SATX-1:
 - select "TX" position of the synch. mode switch (2)
 - press the reset button (3)
 - press initiate (8)

At this stage the transmitter will start and both the green synch (4). LED and red TX+ LEDs (7) will start flashing. The latter flashes concurrently with positive transmitter pulses.

8. The red 'sync' LED on the SiroteM 3 front panel will now come on indicating that it has taken sync. The synch cable can then be disconnected.

Sync will be lost and the sync LED will go off under the following conditions:

- (1) 'Synchronisation' is selected on the Main Menu.

2.4.1 Field Start-Up Procedure in Synchronised Mode (cont)

- (2) Either the Final Window or the Acquisition Delay is increased to a value requiring an increase in the number of 10 or 8.33 msec periods which has been selected.
 - (3) The mains rejection frequency is changed.
9. Measure the loop current being delivered by the SATX-1 as follows:
Select "TX Curr." on the "System Display" function switch (14) and current in AMPS will be displayed.
- NOTE : SATX-1 should always be operated with the lid open. The heatsink in the lid and case front will heat significantly and must be kept clear to allow air circulation.
10. On SiroteM 3, select the 'Data Acquisition' menu then select 'Loop Current' and key in the measured value.
11. Connect the appropriate receiving element to the loop connector socket of the SiroteM 3 (RVR-1E, DHR-1 etc). The unit can then be used as a receiver remotely from the transmitter. Normal data acquisition can be started by pressing 'initiate'.

A FEW POINTS

- (a) Normally the transmitter of the SIROTEM 3 is inhibited while synchronised. However, it is still possible to carry out a calibration run without losing synch.
- (b) At any stage the transmitter can be temporarily inhibited without losing synch. by momentarily turning the "synch. mode" switch to the "CABLE" position and back to "LOCK".

2.4.1 Field Start-Up Procedure in Synchronised Mode (cont)

This is useful should you require to make a change to the loop or desire to reduce battery consumption. To re-enable the transmitter, momentarily switch to the "TX" position and back To "LOCK". The TX- LED should once again start flashing. (If not, press the "INIT" switch while in the "TX" position and synch. will still be maintained.

- (c) Local noise readings can be taken by temporarily inhibiting the transmitter unit as described in (b) and taking a receiver reading as described in 2.4.13. Always disconnect synch. and phase cables from SIROTEM for this process.

2.4.2 To Check Oscillator Drift Rate

Connect the phase cable between the "interface" socket on the SIROTEM receiver and the "1MHz IN" socket on SATX-1. Select the "phase" position of the "system display" function switch on the SATX-1.

The phase angle between the two units' oscillators will be displayed as a value between -180 degrees and +180 degrees. The rate of change of this value denotes the drift rate of the two units relative to each other. For guidance a shift of 6 degrees per minute corresponds to a drift rate of 1microsec/hour which is more than acceptable for most purposes. If drift rate exceeds this value refer 2.4.10 for oscillator adjustment procedure.

For check purposes, the "1MHz IN" and "1MHz OUT" connectors on one SATX-1 can be connected together. A phase angle of less than 6 will generally be displayed but above all should not change more than +/- 0.2 degrees once connected.

With no external signal connected to the phase-meter, a value of -1 is displayed.

2.4.3 To Operate System in Conventional Mode (ie without Synchronisation)

On the 'Data Acquisition' menu, set the Final Window to 50 and press return. The sync LED should go off. Then reset the Final Window to the desired value.

- If it is required to conserve power especially if turning unit off between reading stations, turn the "oven" switch to "OFF". (But not if more synch. operations are to be carried out.)
- The SIROTEM II can now be used in the same manner as described in its Operation Manual.

2.4.4 To Acquire Synch. from the Loop Primary Field

- The transmitter must be running and driving the loop to be used for synchronising.
- Connect RVR-1E to the receiver's loop connector and place it approximately six inches from the loop wire on outside (for the usual polarity convention).
- Set up SIROTEM 3 as described in 2.4.1 step 5.
- If the opposite RVR-1E polarity convention is in operation, readings will be reversed in sign compared to those obtained through cable synchronisation. This is easily overcome by placing RVR-1E inside the loop during synchronisation.

2.4.5 Measuring Loop Current Turn-Off Time

- Set up SATX-1 to be transmitting into the loop of interest as described in Section 2.4.1.
- Select "turn-off (uS)" with the "timing display" function switch.
- The duration of the TX current turn-off ramp will then be displayed in micro-seconds.

2.4.6 Measuring TX Off-Time

- Set up SATX-1 to be transmitting, but a loop need not be connected.
- Select "off-time (ms)" with the "timing display" function switch.
- TX off-time will then be displayed in milliseconds. For a unit set up for 50Hz interference rejection, the value will be a multiple of 10msec. If it is set up for 60Hz rejection, a multiple of 8.3msec will be displayed. This will be truncated to a whole number of milli-seconds with some jitter in the least significant digit.

2.4.7 Measuring Elapsed Time

Select "elapsed time (HH-MM)" with the "timing display" function switch.

The time for which this position has been selected is displayed to a resolution of one minute but with one minute uncertainty. This facility is useful for keeping track of warm-up time or time since synchronisation was performed.

Selecting another "timing display" switch position automatically resets this timer.

2.4.8 Supply Voltage Checking

SATX-1 can monitor the instrument (LV) and loop (HV) supply voltages by simply selecting the appropriate "system display" function switch positions. The voltage displayed is that appearing between the positive and negative supply lines. ie. an LV of +/-12V will be displayed as 24V.

2.4.9 TX Loop Current Measurement

The loop current is displayed in AMPS on the SATX-1 "system display" when the "TX curr." position is selected with that display's function switch. Resolution is to 0.1A.

2.4.10 Oscillator Adjustment

WARNING

All oscillators are adjusted before despatch from the factory after at least a 24 hour warm-up period. No adjustment should be undertaken unless the units being compared have been powered-up (with ovens on!) for at least this period.

Under **NO** circumstances should the oscillator coarse adjustment be touched **EVER**.

- Set up the units to be compared to check the oscillator drift rate as indicated in Section 2.4.2.
- If drift rate is satisfactory do nothing! (eg. a drift of 6 degrees per minute yields a synch. error of 1microsec/hour which is satisfactory for most purposes).
- Use the oscillator fine adjustment vernier dial (17) on the front panel.
- Adjustments should be small and with a pause between each to gauge effect.
- The aim is to adjust for minimum rate of change of phase, the actual phase angle being irrelevant.
- If phase angle is decreasing (or becoming more negative) turn adjustment clockwise to correct (and vice versa).

Always remove phase cable from SIROTEM before performing data collection to avoid degradation of instrument noise performance.

2.4.11 Hints Toward Good Oscillator Stability

In common with other quartz crystal oscillators, the units used in SIROTEM exhibit the following characteristics which should be borne in mind.

1. The long-term stability is governed by the aging rate of the crystal which decreases with the time for which the oscillator has been in service. Accordingly oscillator adjustments (if required at all) will be required less and less frequently as time goes on.
2. Stability achieved is improved if power is applied to the oscillators for as great a percentage of the time as possible. The auxiliary power connector makes this a relatively simple matter, the drain being approximately 250mA average.

If two units which are to be synchronised must be powered down, it is best to power them up and down together. In this way they will track back to their ultimate frequency along approximately the same curve and better frequency matching during warm-up will result.

Adequate stability will be obtained even if two units in use are powered down overnight and allowed to warm up for 30 minutes before operations start for the day. This assumes they have been adjusted in accordance with the rules in Section 2.4.10.

3. SIROTEM is best kept orientated in either its carrying or operating position only for optimum stability. This corresponds to the axis of minimum gravitational effect.
4. Use SIROTEM units with the oscillator ovens turned on unless there is a good reason to do otherwise (eg. battery consumption when using the unit's internal transmitter in conventional mode).

2.4.12 Transfer between Main and Auxiliary Power

(a) Aux. to Main

- Plug in power supply to the unit's main power supply connector.
- Switch unit ON at power switch.
- Remove auxiliary supply connector.

(b) Main to Aux.

- Plug in power supply to auxiliary power connection.
- Switch unit OFF at power switch.
- Remove main power supply connector.

2.4.13 Local Noise Readings

A SIROTEM 3 can be used to measure local noise levels while the transmitter is inhibited as described on page 20. An RVR-1E, DHR-1 or loop can be used as the receiving element as required.

On the 'Data Acquisition' menu, select Run Type and press 'ENTER' several times until 'Null run (noise)' is selected. Then press 'initiate' to acquire data in the normal way. For a noise run, a current of 1.0 Amp is assumed so that the data readings obtained are in nanovolts.

NOTE

Always disconnect phase and synch. cables from SIROTEM when performing noise tests of any sort.

FIGURE 3 : Connection Arrangement for a Battery
MPTX Supply

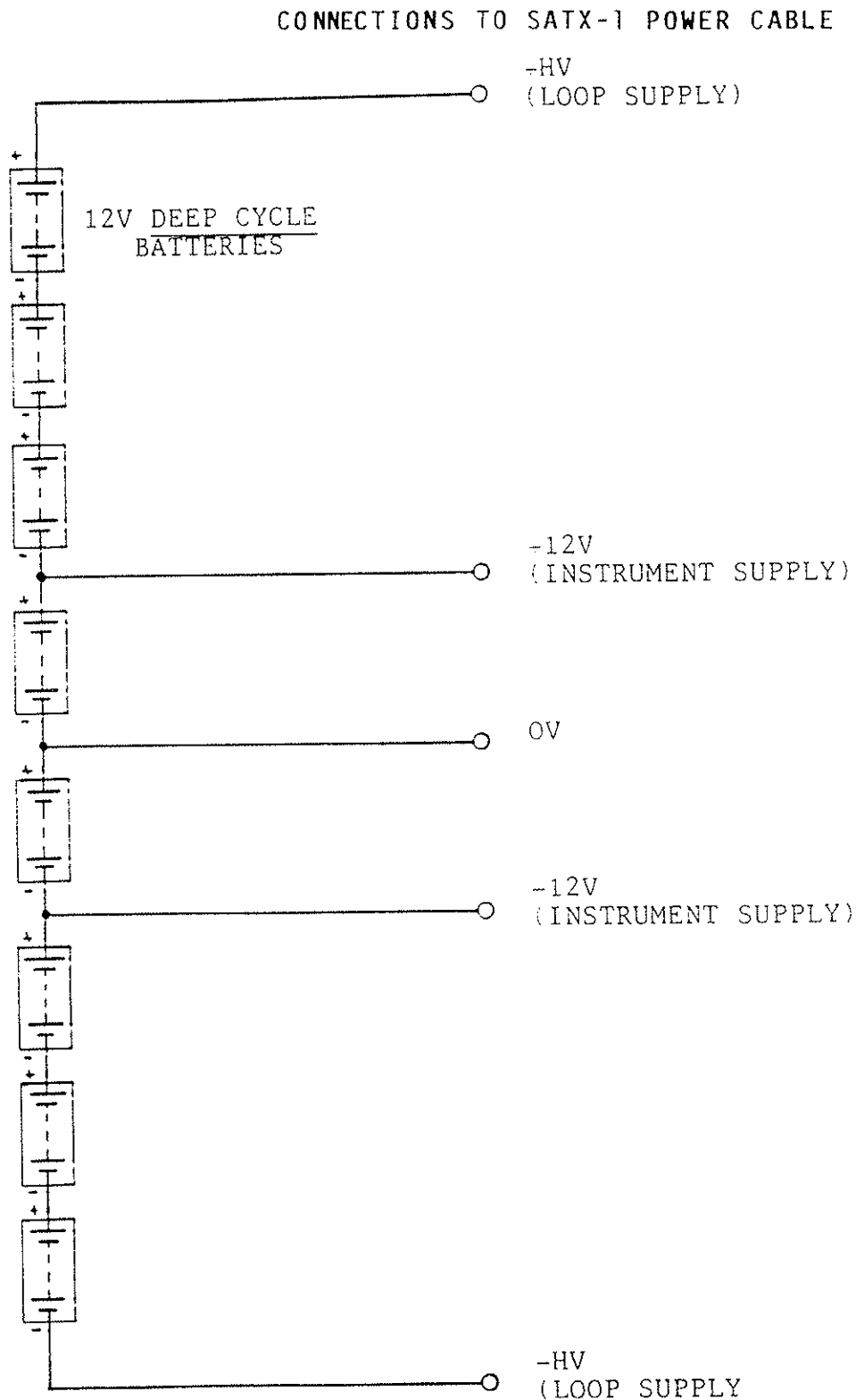


FIGURE 4 : A Suitable MPTX Power Supply Connection Arrangement

CONNECTIONS TO SATX-1
POWER CABLE

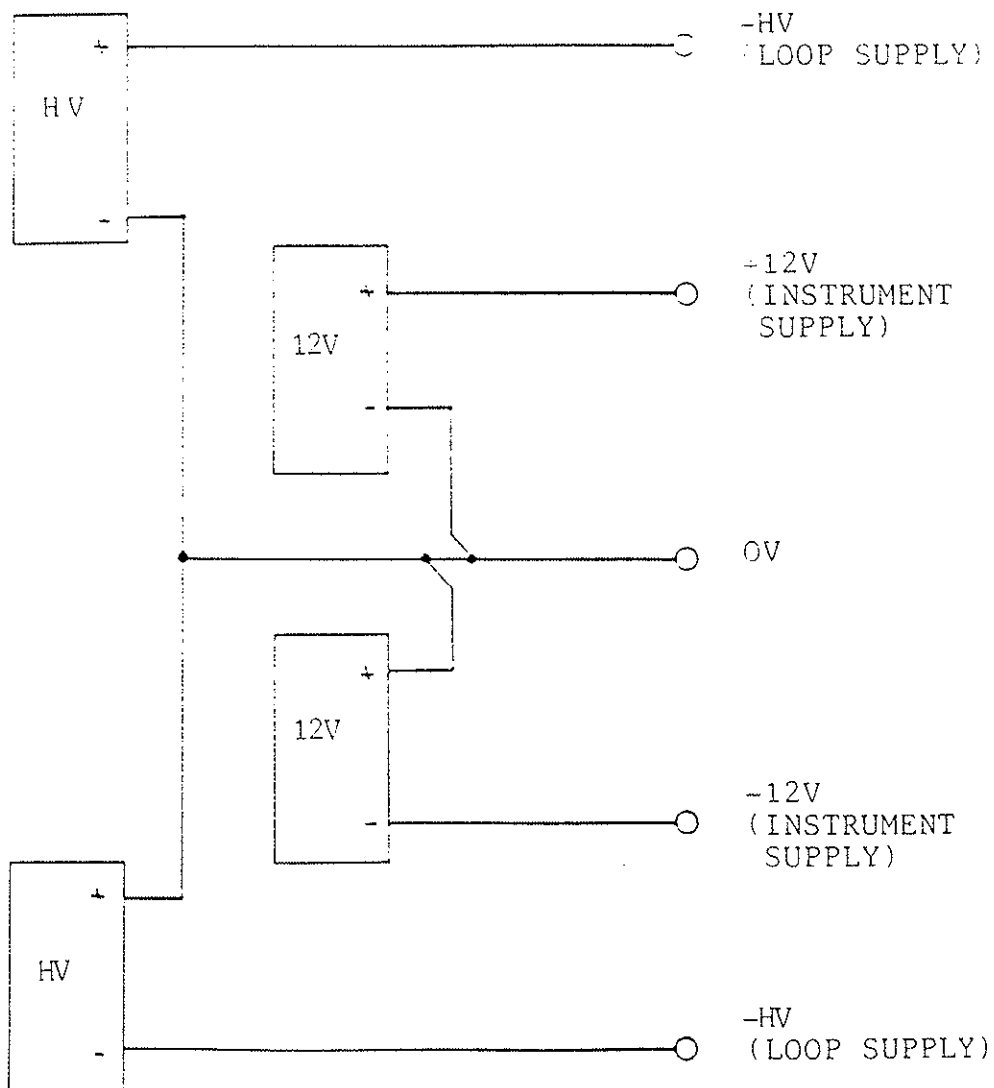
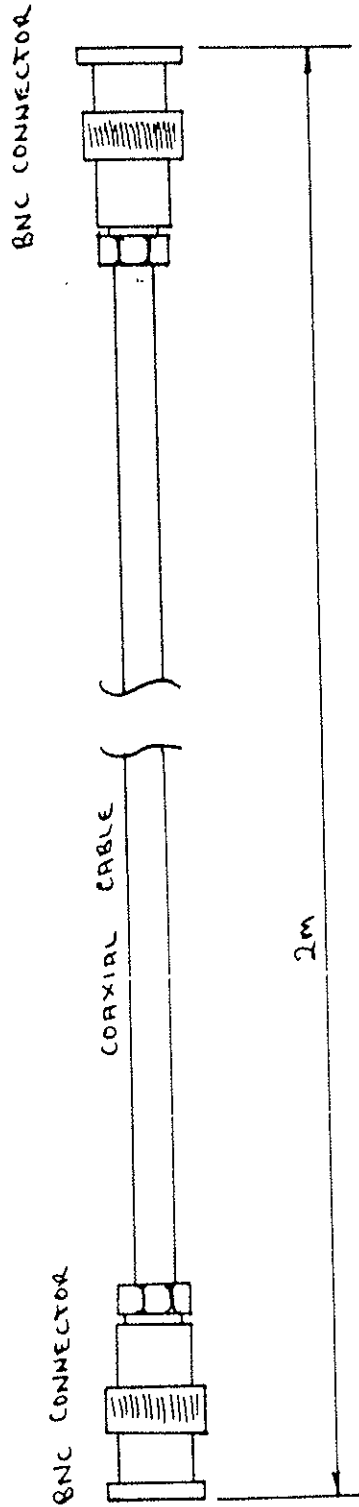


FIGURE 5 : Sync Cable



SIROTEM SYNC CABLE

MS1041

S41201

FIGURE 6 : Phase Cab

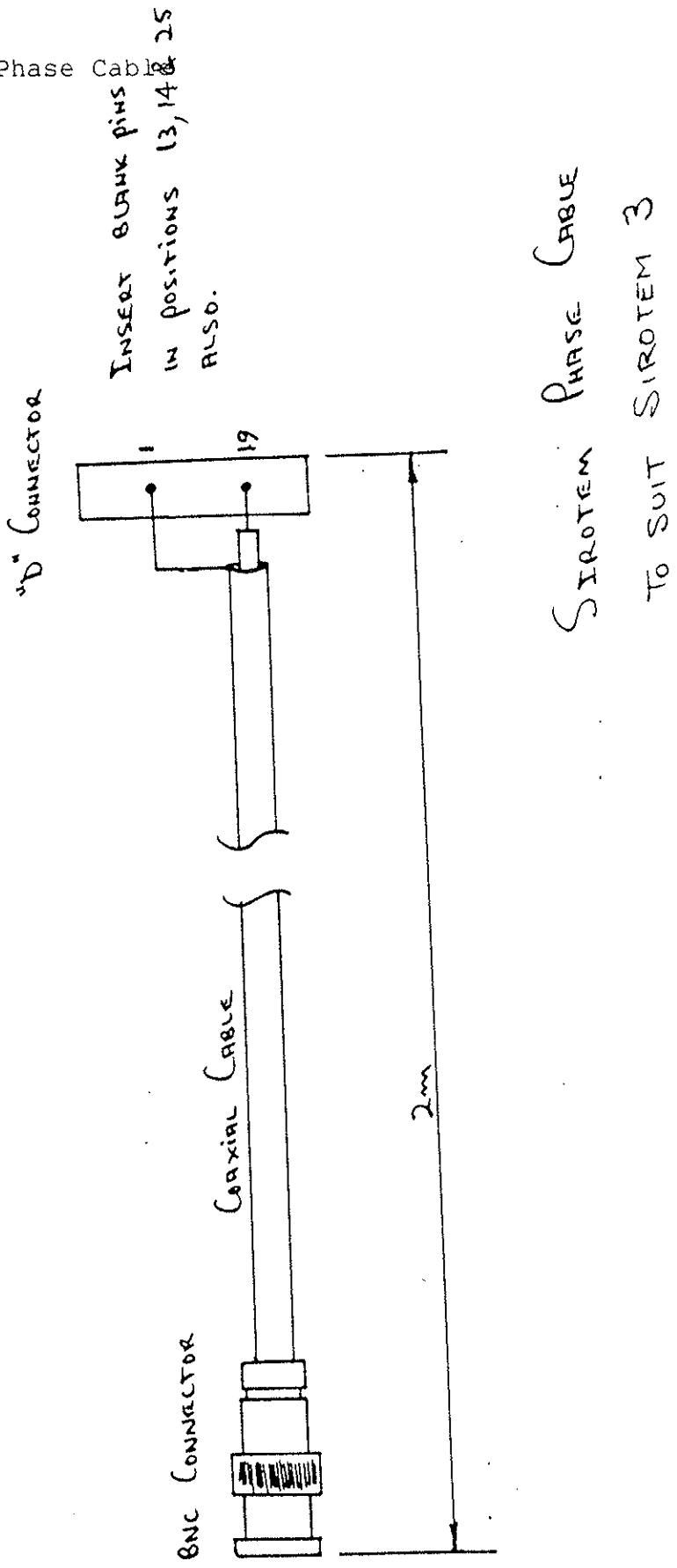
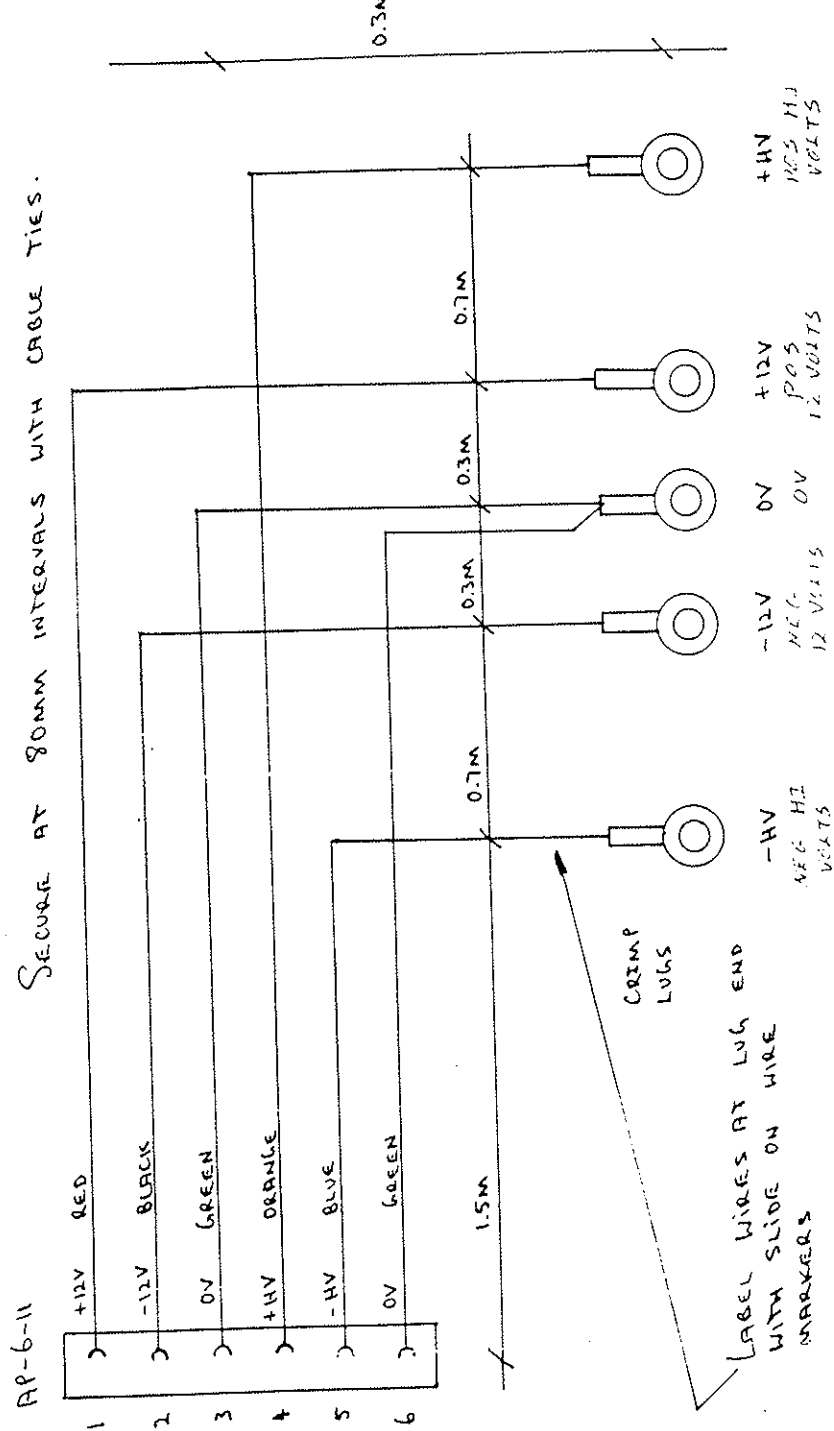


FIGURE 7 : SATX-1 Battery Power Cable

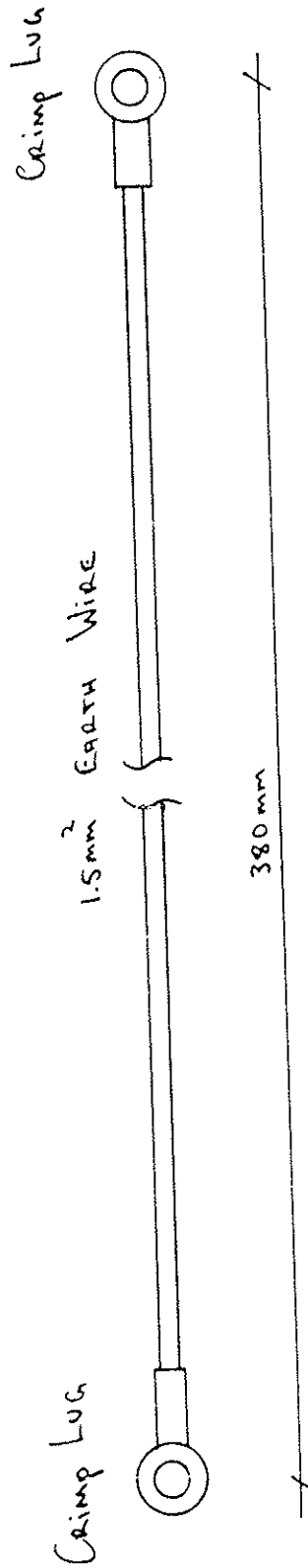


SIROTEM
SATX-1 BATTERY POWER CABLE

MS1045

541205

FIGURE 8 : Battery Interconnection Cable

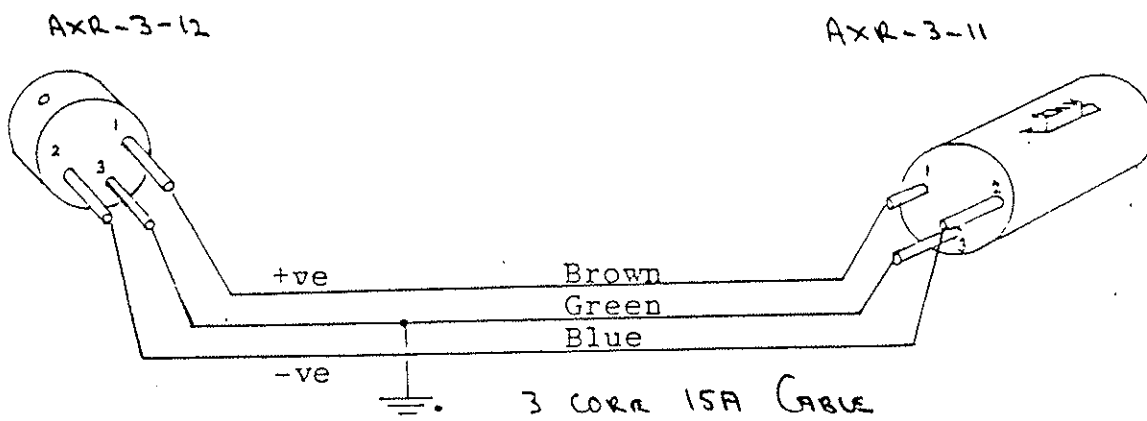


BATTERY INTERCONNECTION
CABLE

MS1048

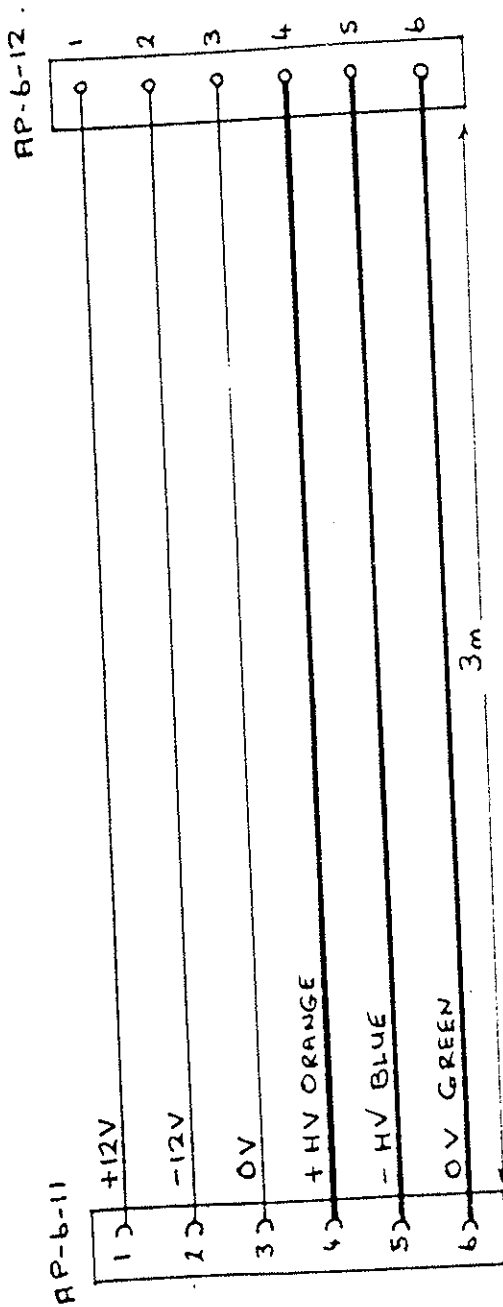
S41208

FIGURE 9 : SATX-1 Auxiliary Battery Power Cable



SIROTEM -
AUXILIARY BATTERY POWER CABLE
MS 1043
541203

FIGURE 10 : SATX-1 - Interface Power Cable



30/.25

7/.67

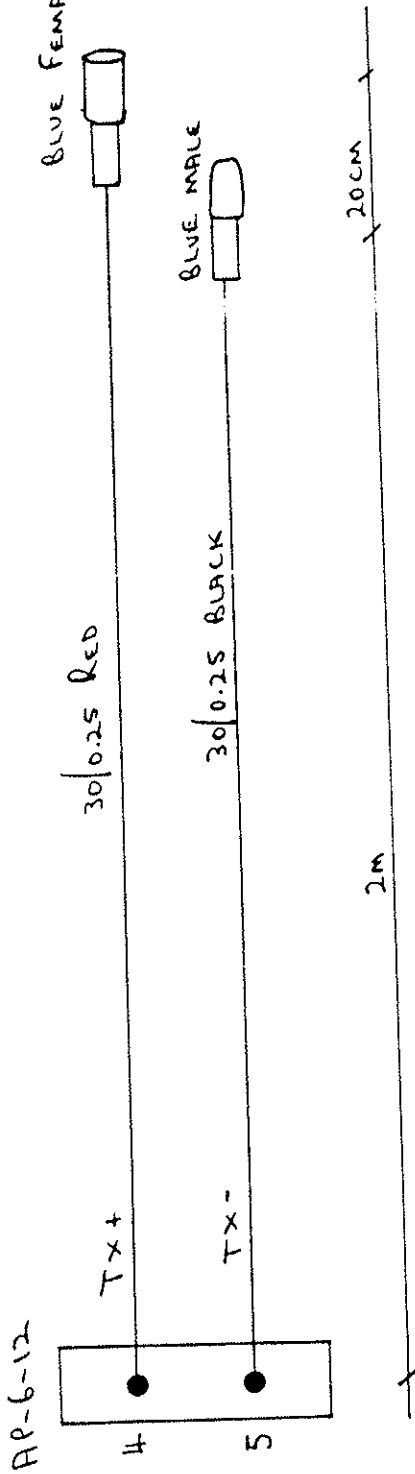
SIROTEM
SATX-1 - GENERATOR
INTERFACE CABLE

MS1096.

S44461

FIGURE 11 : SATX-1 Loop Cable

BULLET CONNECTORS



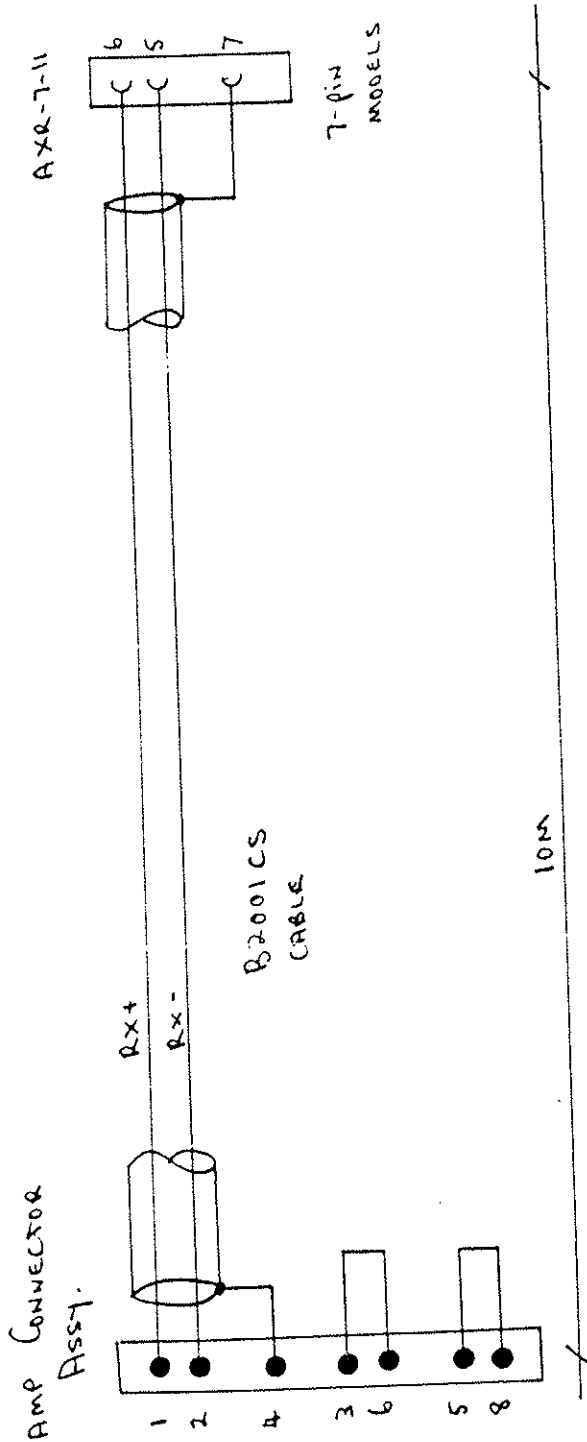
TIE CABLES TOGETHER WITH LOOPS OF HEATSHRINK TUBING AT ~ 20CM INTERVALS AND RIGHT AT BULLET CONNECTOR END.

SIROTEM
SATX-1 Loop Cable

MNS1044

541204

FIGURE 12 : RVR Connection Cable



SIROTEM
 RVR CONNECTION CABLE
 (FOR SYNC OPERATION)

MS1047

54.207

FIGURE 13 : SIROTEM 3 Adapter Cable

