19. FAST TRANSIENT ELECTROMAGNETICS

NOTE: Much of this information has been extracted from the GDP-32^{II} Receiver manual, ***Section 7 DATA*** and ***Section 12 TEM.***

19.1 THE NANOTEM SYSTEM

The NanoTEM system is a very fast turnoff and sampling TEM option available for the GDP-32^{II} receivers. The equipment consists of a high-speed sampling card (Board 194) for the GDP, a battery powered NanoTEM transmitter and a few loading resistors.

The receiver board samples the decay waveform at either 1.2 or 1.6 microsecond intervals, and then stores the data in an on-board memory buffer. Then the data are transferred to the main GDP memory where the samples are combined to form time windows on a logarithmic scale.

The NanoTEM transmitter is configured for very fast turn-off, is powered by a 12-volt battery, and can output up to 4 amperes. Two versions of the NanoTEM transmitter are available. The first, the NT-20, is an external transmitter system, and the second is the NT-32 that utilizes a transmitter integrated within the GDP-32^{II} case.

Operating instructions for the NT-20 transmitter are included in a separate manual included with the NT-20. Instructions for effective operation of the NT-32 system are included in ***Section 19.3***.

*NOTE: Board 194 has a fixed gain stage of x10, which cannot be changed. Therefore, the receiver moment must be multiplied by a factor of 10 (as shown in **Section 19.2**, step 9) to get the correct resistivity numbers. There is also a variable gain stage with selections of 1, 2, 4, 8 and 16, which can be set automatically with the NanoTEM program.*

NanoTEM Configuration

NanoTEM Card for the GDP-32^{II}

NT-20 or NT-32 Transmitter

Wire for TX loop - 10 x 10 m, 20 x 20 m, etc.

Wire for RX loop - presently using 5 x 5 m by 1 turn for 20 m TX loops and 10 x 10 m for 40 m TX loops.

Battery for NT-20 or NT-32

Battery charger

Cable: RX loop to GDP - twisted pair with 150 ohm load resistor with alligator clips on the receiving antenna end and a 1 kΩ balanced bridge resistor on the other end, which plugs into the GDP. The cable should be approximately 14 meters long for a 20 x 20 m loop.

Cable: transmitter control - from NT-20 to GDP (not needed for NT-32)

Cable: battery power for NT-20

Two options:

a) cable for using two 12 Volt car batteries

b) cable for using 12/24 Volt 10 amp-hour battery pack

CAUTION: NanoTEM operation requires 12-volt supply only.

19.2 NANOTEM HOOKUP DIRECTIONS

Using a 20 X 20 m Transmitter Loop and NT-20 or NT-32 Transmitter

1. Use the 1 K-ohm bridge that is supplied. Plug it into the input for the channel that has the NanoTEM card (channel 3 in this example), and connect the ground wire to COM.
2. The 150 ohm resistor mounted on the Pomona plug must be connected across the receiver coil as shown in ***Section 19.9***.
3. Observe the color-coded hookups as shown to get the proper polarity for received data.
4. VERY IMPORTANT: Upon turn-on, the NT-20 transmitter may come up on a setting other than a 20 meter loop. You MUST set it to the proper loop size to get the proper turn-off time.
5. For 20 meter loop operation, run the TX at 3 amps. Maximum current is about 4 amps.
6. Insulate the clips on the ends of the 20 meter TX loop sections to make sure you do not have leakage. This is not necessary in very dry conditions.
7. Do the same for the resistor load on the RX antenna, which is 5x5 meters for this example.
8. Header information from **Menu 1**:

   Array Type : NanoTEM
   Duty cycle : 50%
   Receiver moment : 250
   Transmitter X,Y : 20 , 20 Turns: 1
   TX delay : 1.5 microseconds
   Antenna delay : 2 microseconds
   Transmitter type : NT-20 or NT-32
   Automatic gain mode
   Alias filter IN

9. Note that the receiver moment is set to 250 meters squared even though the RX loop is 5 x 5 meters. The extra factor of 10 compensates for a gain of 10 on the NanoTEM card.
10. If using the NT-32 transmitter, pressing the GAIN/F10 key, then entering 8 from the data collection menu will accesses configuration of the NT-32 internal transmitter. The damping resistor should be set to 250 and transmitter loop size set to 20.
11. Take two stacks of 1024 cycles, unless the data are coming in clean with shorter stacks.

Using Transmitter Loops Other Than 20 Meters

If you are using an NT-20 transmitter, be sure to set the **LOOP SIDE** switch on the NT-20 to the closest smaller value for the transmitter loop being used. For example, a 61-meter loop should be set to 50 meters on the NT-20. The new loop dimensions should also be entered in Menu 1.

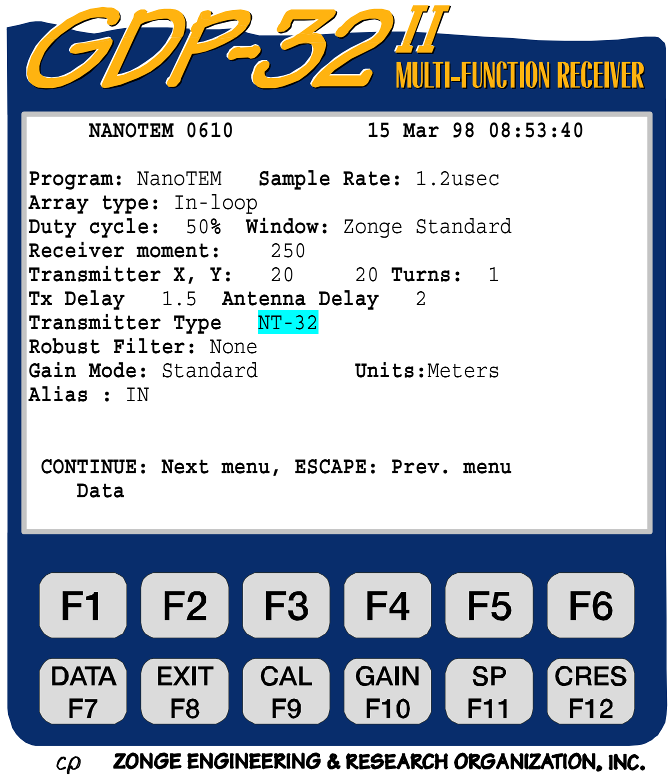
If you are using an NT-32 transmitter, the damping resistor value may be changed to correspond to the loop dimensions. A chart for estimated damping resistor values is included at the end of ***Section 19.3***.

19.3 NT-32 TRANSMITTER SYSTEM

Setup of the NanoTEM system using the NT-32 transmitter is similar to the steps used when using all of the other Zonge Transmitter systems.

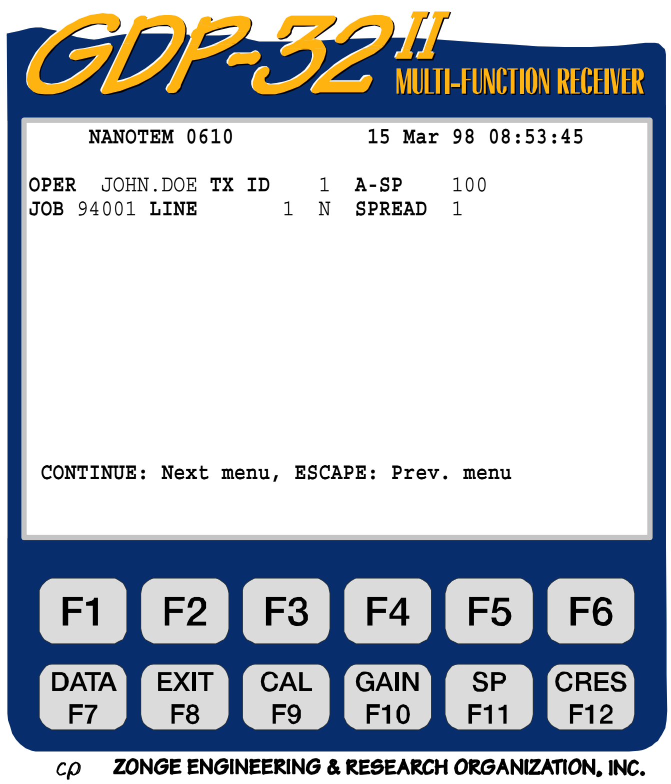
Menu 1

Configuration information is entered into Menu 1 in the GDP-32II data program as outlined in ***Section 12.5***. Of particular importance is the Transmitter Type, which should be set to **NT-32**.



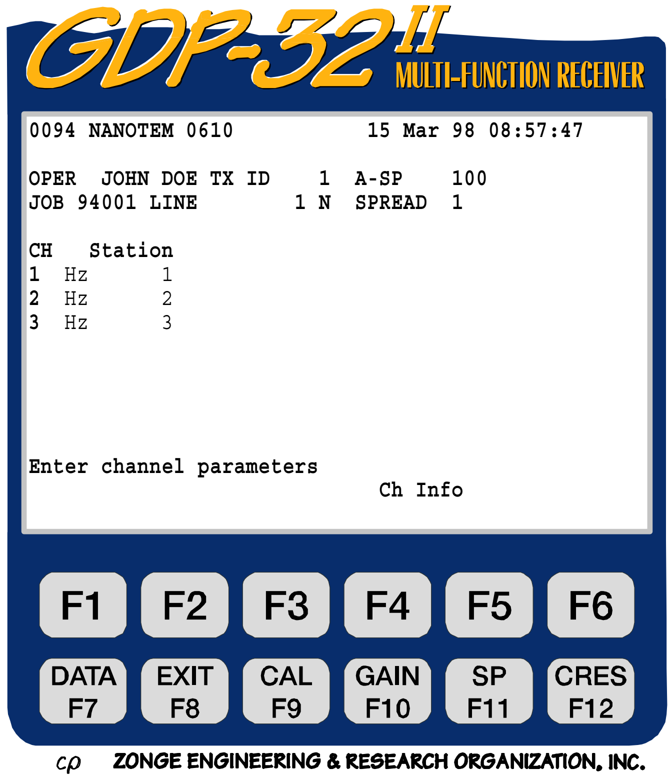
Menu 2

After initializing the NT-32 Transmitter, the data collection program continues on to Menu 2 allowing entry of record keeping information such as line number, operator name, etc. A-Spacing (**A-SP**) is displayed in this menu, but it is not used for NanoTEM.



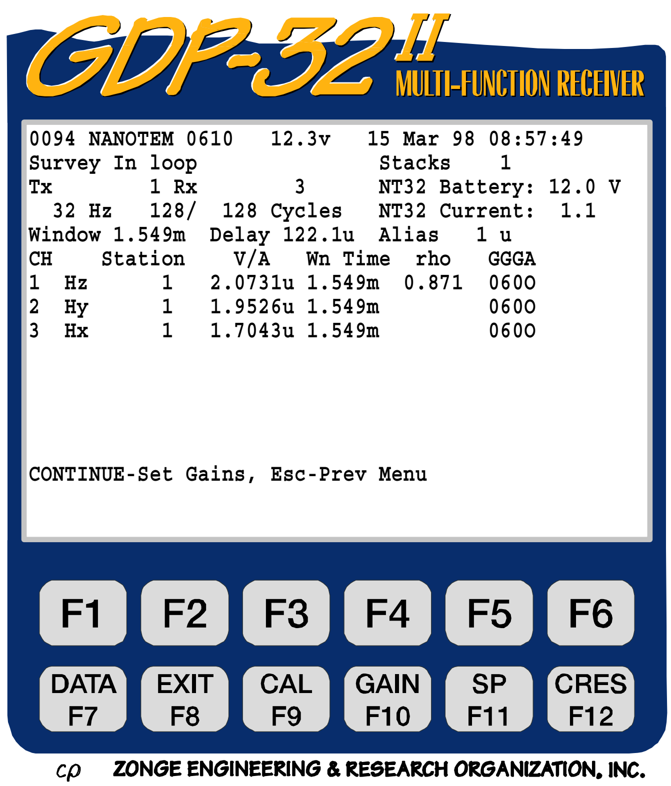
Menu 3

Menu 3, as with all of the data collection programs in the GDP-32^{II}, allows individual channels to be enabled, station numbers to be entered for each channel, and configuration information for the channels (Hx, Hy, or Hz) to be entered. Below is a configuration for making vertical magnetic field measurements at three separate stations.



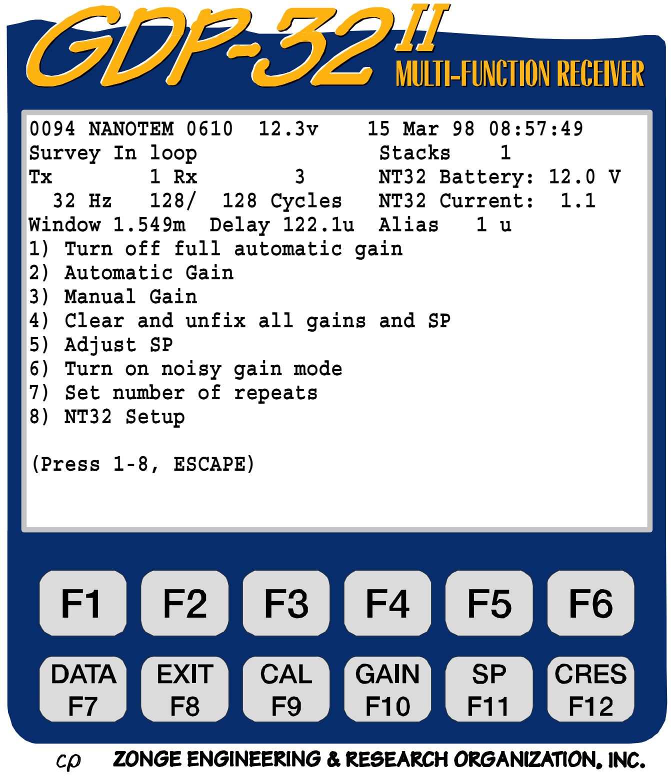
Menu 4

Menu 4 is the primary data collection screen. Control over the configuration of the NT-32 transmitter is gained though pressing GAIN F10 key while in this menu. The other portions of this menu are described in detail in ***Section 12.5***.



Gain/F10 SubMenu

The setup menu for the NT-32 transmitter can be accessed by pressing **8**. This will bring up the NT-32 configuration menu.

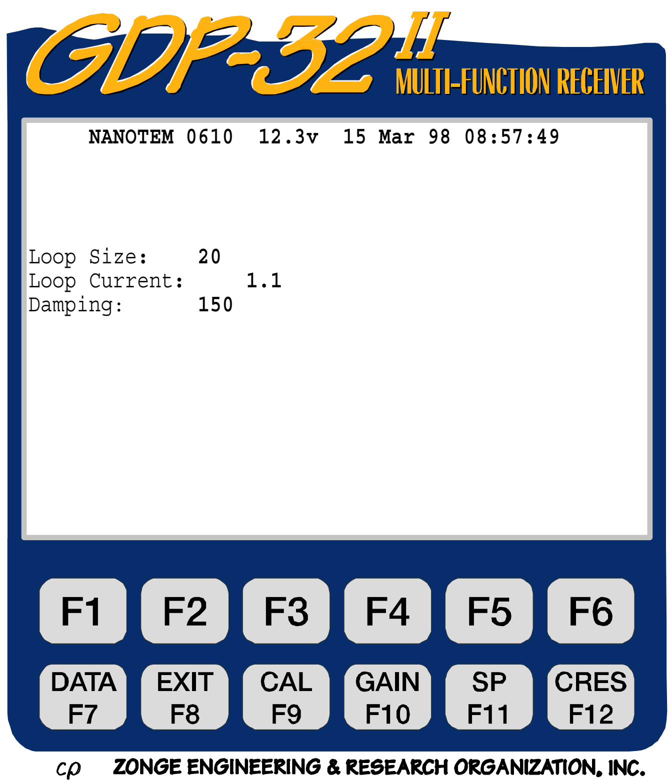


NT-32 Configuration Menu

Loop Size: Transmitter loop side in meters

Loop Current: Adjust output current (measured in Amperes)

Damping: Damping resistance in ohms, determined by the Tx loop size. Refer to the charts on the next page.



Damping: Adjustment for transmitter damping resistors. Damping resistance values are available from 50 to 1550 ohms in steps of 50 ohms. These values can be changed by pressing [SELECT UP / Home] and [SELECT DN / End]. The best choice for damping resistors is a complex function of the loop size and the electrical resistivity of the area in which measurements are being made. The chart below offers estimates of damping values for different transmitter geometries.

Tx Loop Size (m)	Damping Resistance (ohms)
5	100
10	150
20	250
40	450
80	850
100	1000

19.4 NANOTEM TURNOFF TIMES

The following are some approximate turnoff times for a selection of transmitter loop sizes:

Loop Size	Turnoff Time
10 x 10 meter loop	1.2 µs
20 x 20 meter loop	1.5
40 x 40 meter loop	3.0
100 x 100 meter loop	6.0

The NanoTEM program has been used successfully in highly conductive as well as highly resistive environments.

19.5 NANOTEM FIELD DATA CACHE

At this time, all of the GDP-32^{II} programs, except for the NanoTEM program, initialize the data cache according to the outline in Chapter 7.4. Initialize the NanoTEM data cache as follows:

If you are in the NanoTEM program, get into the first menu and

Press `2 Utilities,` then

Press `6 Turn off power`, then

Press [CONTINUE / Enter]

The LOGO screen will now be displayed. This is also where you will enter the program if you have just turned the receiver on. The cache file may be deleted using either a DOS or WINDOWS procedure.

DOS PROCEDURE FOR NANOTEM CACHE INITIALIZATION:

Press F1 to get into DOS. The `C:\>` prompt will be displayed.

Type: `DEL NTDATA.CAC`

Type: `DIR /P` and page through the files. `NTDATA.CAC` should not be included.

Type: `MENU`

The LOGO screen will now be displayed.

WINDOWS PROCEDURE FOR NANOTEM CACHE INITIALIZATION:

When the LOGO screen is displayed, press F2 to get into WINDOWS

If you do not have a mouse attached, press CONTINUE Enter (OK) for Mouse Support display box.

Press CONTINUE Enter (YES) for the DHCP box

Windows EXPLORER is now activated

Press SHIFT - NEXT FIELD Pg Dn to see the bottom of the display and the file listings

Press ↓ until you highlight the file `NTDATA.CAC`

Press ← DEL. The following message will appear

Are you sure you want to send `NTDATA.CAC` to the recycle bin?

If YES is not highlighted, press → to highlight YES

Press CONTINUE Enter. `NTDATA.CAC` should be deleted from the screen

Press SHIFT - SELECT DN End to view the lower left-hand part of the screen

Press CTRL - STOP AVG Escape

Press the down arrow to highlight `SHUT DOWN`

Press CONTINUE Enter

Press ↓ and CONTINUE Enter to `RESTART` the computer, if desired,

Otherwise press CONTINUE Enter to turn the computer off.

Press SHIFT - SELECT UP Home to get back to the original position of the screen

DATA TRANSFER FROM NANOTEM CACHE

Data from the data cache (**NTDATA.CAC**) can be downloaded or transferred by two methods. The direct method uses a RS-232 (COM 1) serial port transfer from the NanoTEM program as explained in ***Section 19.12***. Large files will require a long time to transfer with this method. A fast alternative method is to use the LAN and connect to a network or a laptop PC. The files transferred by this method need to be reformatted with the NTCNVRT.EXE program that is included on the Zonge software CD-ROM.

1. Turn off the GDP-32^{II}
2. Connect the GDP-32^{II} to the network using the multi-function interface cable.
3. Start the GDP and get into WINDOWS as described in the previous section. Once WINDOWS is running, the GDP-32^{II} should appear in the Network Neighborhood of the other computers on the network. The device name for the GDP is "**GDP32ii SNxx**" where **xx** is the GDP front panel serial number. The NanoTEM cache file is located in **d:\data**.
4. Now you can drag files from the GDP (or copy updated programs to the GDP). Place the program NTCNVRT.EXE into the same folder as the **NTDATA.CAC** cache file you wish to convert.
5. Double click on the icon for NTCNVRT.EXE
6. The program will convert the **NTDATA.CAC** file in the folder to an ASCII file **NTDATA.PRN**. To use Zonge Engineering data processing software rename the file **NTDATA.RAW** and begin the data processing with the programs SHRED.EXE and TEMAVG.EXE.

19.6 NANOTEM WINDOW CENTERS

SAMPLE PERIOD: 1.6 MICROSECONDS

Zero Delay After Current Turnoff

WINDOW #'S	POINTS PER WINDOW	WINDOW CENTERS	WINDOW WIDTHS BEGINNING	END
1	1	0.0 μ sec	0.0 μ sec	0.0 μ sec
2	1	1.6	1.6	1.6
3	1	3.2	3.2	3.2
4	1	4.8	4.8	4.8
5	1	6.4	6.4	6.4
6	1	8.0	8.0	8.0
7	2	10.4	9.6	11.2
8	2	13.6	12.8	14.5
9	2	16.8	16.1	17.7
10	3	20.8	19.3	22.5
11	3	25.6	24.1	27.3
12	5	32.0	28.9	35.3
13	6	40.8	36.9	45.0
14	7	51.2	46.6	56.2
15	9	63.9	57.8	70.7
16	11	79.9	72.3	88.3
17	15	100.6	89.9	112.4
18	18	127.7	114.0	142.9
19	23	161.2	144.5	179.9
20	29	202.7	181.5	226.4
21	36	254.6	228.1	284.3
22	47	320.7	285.9	359.7
23	58	404.5	361.4	452.9
24	72	508.3	454.5	568.5
25	92	639.0	570.1	716.3
26	116	804.9	717.9	902.6
27	145	1.013 m sec	904.2	1.135 m sec
28	184	1.276	1.137 m sec	1.431
29	231	1.607	1.433	1.802
30	289	2.022	1.804	2.266
31	369	2.546	2.268	2.859

To demonstrate how to determine the actual window times, we will use the 20 meter loop parameters as an example: add the Tx delay (1.5 μs) plus the antenna delay (2.0 μs) plus the antialias filter delay (1.0 μs) = 4.5 μs. The first sample point after the Tx turnoff and delays is at 4.8 μs (3 x 1.6), so the first window will be at 4.8 - 4.5 = 0.3 μs. The next window will be 1.6 + 0.3 = 1.9 μs, then 3.2 + 0.3 = 3.5 μs, for the next window, etc.

SAMPLE PERIOD: 1.2 MICROSECONDS

Zero Delay After Current Turnoff

WINDOW #'S	POINTS PER WINDOW	WINDOW CENTERS	WINDOW WIDTHS BEGINNING	WINDOW WIDTHS END
1	1	0.0 μ sec	0.0 μ sec	0.0 μ sec
2	1	1.2	1.2	1.2
3	1	2.4	2.4	2.4
4	1	3.6	3.6	3.6
5	1	4.8	4.8	4.8
6	1	6.0	6.0	6.0
7	2	7.8	7.2	8.4
8	2	10.2	9.6	10.8
9	2	12.6	12.1	13.3
10	3	15.6	14.5	16.9
11	3	19.2	18.1	20.5
12	5	24.0	21.7	26.5
13	6	30.6	27.7	33.7
14	7	38.4	34.9	42.2
15	9	48.0	43.4	53.0
16	11	59.9	54.2	66.3
17	15	75.4	67.5	84.4
18	19	95.8	85.6	107.2
19	23	121.0	108.5	135.0
20	29	152.1	136.2	169.9
21	36	191.0	171.1	213.3
22	47	240.6	214.5	269.9
23	58	303.5	271.1	339.8
24	72	381.4	341.0	426.6
25	92	479.5	427.8	537.4
26	116	604.0	538.6	677.2
27	145	760.2	678.4	851.9
28	184	957.1	853.1	1,074
29	231	1,205	1,075	1,352
30	289	1,517	1,353	1,700
31	369	1,910	1,701	2,145

To demonstrate how to determine the actual window times, we will use the 20 meter loop parameters as an example: add the Tx delay (1.5 µs) plus the antenna delay (2.0 µs) plus the antialias filter delay (1.0 µs) = 4.5 µs. The first sample point after the Tx turnoff and delays is at 4.82 µs (4 x 1.205), so the first window will be at 4.82 - 4.5 = 0.32 µs. The next window will be 1.2 + 0.32 = 1.52 µs, then 2.41 + 0.32 = 2.73 µs, for the next window, etc.

SAMPLE PERIOD: 1.2 MICROSECONDS, SHALLOW APPLICATIONS

Zero Delay After Current Turnoff

WINDOW #'S	POINTS PER WINDOW	WINDOW CENTERS	WINDOW WIDTHS BEGINNING	END
1	1	0.0 u sec	0.0 u sec	0.0 u sec
2	1	1.2	1.2	1.2
3	1	2.4	2.4	2.4
4	1	3.6	3.6	3.6
5	1	4.8	4.8	4.8
6	1	6.0	6.0	6.0
7	1	7.2	7.2	7.2
8	2	9.0	8.4	9.6
9	2	11.4	10.8	12.0
10	2	13.8	13.3	14.5
11	2	16.3	15.7	16.9
12	3	19.2	18.1	20.5
13	3	22.9	21.7	24.1
14	4	27.0	25.3	28.9
15	5	32.4	30.1	34.9
16	6	39.0	36.1	42.2
17	7	46.8	43.4	50.6
18	8	55.9	51.8	60.2
19	9	66.1	61.4	71.1
20	11	78.1	72.3	84.3
21	14	93.0	85.6	101.2
22	17	111.6	102.4	121.7
23	20	133.8	122.9	145.8
24	24	160.2	147.0	174.7
25	29	192.0	175.9	209.7
26	35	230.4	212.3	251.8
27	42	276.6	253.0	302.4
28	50	331.8	303.7	362.7
29	59	397.3	363.9	433.8
30	70	474.7	435.0	518.1
31	85	567.7	519.4	620.6

To demonstrate how to determine the actual window times, we will use the 20 meter loop parameters as an example: add the Tx delay (1.5 us) plus the antenna delay (2.0us) plus the antialias filter delay (1.0us) = 4.5us. The first sample point after the Tx turnoff and delays is at 4.8us (4 x 1.2), so the first window will be at 4.8 - 4.5 = 0.3us. The next window will be 1.2 + 0.3 = 1.5us, then 2.4 + 0.3 = 2.7us, for the next window, etc.

19.7 NANOTEM SAMPLE DATA

```
0778
NANO0534 94-12-31 17:58:13 11.7v INL
OPER       SAU TX ID  T-21 A-SP      1
JOB 94118 LINE        4 N  SPREAD  1
 50% RxM  10000 TxX    1 TxY    1 #T  1 Ref 0.113
Tx Delay  1.5 Antenna Delay    2 Alias IN
Robust None
1  LoPass  Notch+60,3-5,9  S/N  117 Passed 1.00014
2  LoPass  Notch+60,3-5,9  S/N  114 Passed 0.99794
3  NanoTem A/D   14-bit    S/N    2 Passed 1.00000
Front Panel S/N   21, Cal S/N   15, Temp  20.0, Humidity  51.4, EPROM ZMT-32 Z201s
```

NanoTEM Channel 3

```
0779
NANO0534 94-12-31 18:00:05 11.6v INL
Tx        1 Rx        3 N OUT
  32 Hz    512 Cyc Tx Curr     1 4.819u    1u  1.606u
3  Hz      3  59.005u  80.23u  12.97  040O 14.61u    0.00     0
  Wn     Mag 3    Rho 3
 0.319u  19.863m  2692.5
 1.925u  4.8605m  343.38
 3.531u  2.8371m  178.83
 5.137u  2.0226m  119.96
 6.743u  1.4475m  95.275
 8.350u  1.1190m  79.222
 10.73u  900.31u  60.311
 13.95u  611.69u  50.388
 17.16u  499.88u  40.790
 21.14u  391.33u  33.942
 25.97u  294.99u  29.080
 32.28u  221.91u  24.461
 41.08u  162.99u  20.108
 51.49u  118.19u  17.097
 64.24u  86.311u  14.580
 80.23u  59.005u  12.974
 100.9u  51.056u  9.7527
 128.0u  38.916u  7.8601
 161.6u  30.188u  6.3142
 203.1u  22.741u  5.2111
 255.0u  20.282u  3.8488
 321.0u  18.985u  2.7393
 404.9u  14.122u  2.2663
 508.7u  12.730u  1.6603
 639.4u  8.2726u  1.5116
 805.4u  6.1923u  1.2482
 1.014m  4.9634u  0.9859
 1.276m  3.1665u  0.9065
 1.607m  2.7103u  0.6845
 2.022m  0.9478u  0.9404
 2.547m  0.1911u  1.8622
```

The above data were acquired using a dummy load on an NT-20 transmitter.

19.8 THE NANOTEM CALIBRATE BOX

The NanoTEM Calibrate Box is a resistor-capacitor network that provides a load for the NT-20 Transmitter when operating in the NanoTEM mode, which generates a decay transient suitable for measurement in the NanoTEM decay windows.

SETUP

Refer to the ***NT-20 NanoTEM Calibrate Setup*** schematic diagram showing the setup for testing the GDP-32II with the NanoTEM Calibrate Box. Refer to ***Section 12.3*** to set up the correct header information for TEM. Follow the steps enumerated below and refer to the figure:

1. Connect the NT-20 transmitter outputs to the corresponding TRANSMITTER jacks (**BLUE** and **BLACK** banana jacks) of the NanoTEM Calibrate Box. Use the 60 cm twisted-pair cable provided with the calibrate box.

2. Plug the NT-I terminal connector (i.e., black double banana plug with single banana plug pigtail cable) into a GDP-32II input channel corresponding to a NanoTEM analog card. Plug the pigtail into the **COM** jack of the GDP-32II.

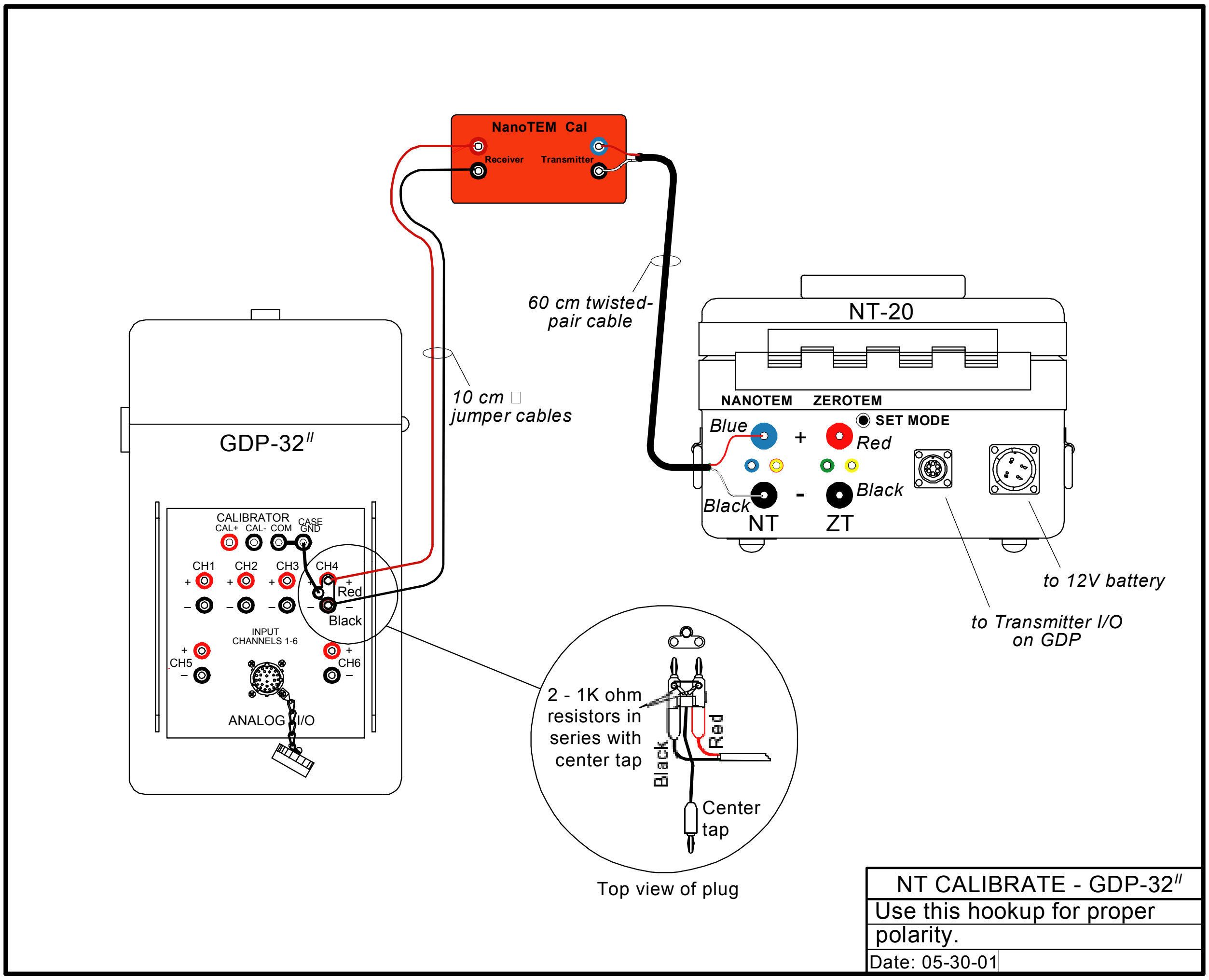
3. Connect the RECEIVER outputs of the NanoTEM Calibrate Box to the input channel containing the NT-I terminator plug, **RED** to **RED** and **BLACK** to **BLACK**. Use 10 cm jumper cables.

4. Connect the NT-20 power cable to a 12Vdc power source and the Transmitter I/O cable from the GDP-32II to the corresponding cable connector on the NT-20.

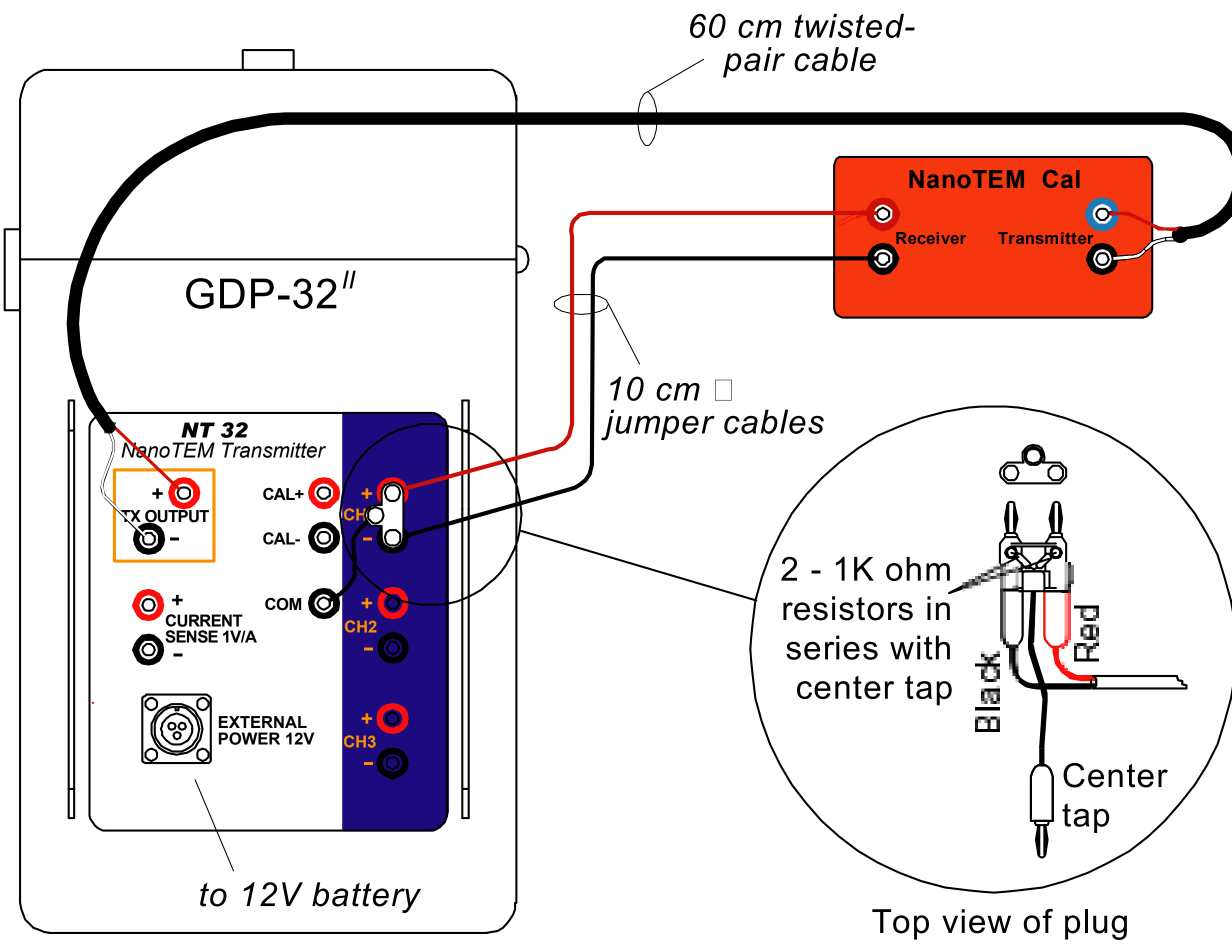
5. The results plotted in the ***NanoTEM Calibrator Decay Transient*** figure show the transient curve for 1.2 µs sampling and 1.6 µs sampling, respectively with the antenna delay set at 2 µs and the Tx delay set at 1.5 µs. The ALIAS filter was set to **IN**. The receiver moment was set for a standard 5mx5m loop (RxM = 250). The output current of the transmitter should be adjusted to 1 A.

The recorded signal levels are normalized by current so it is important that the output current be set to one amp if decay curves are to be compared to those in the figure. Also remember that you are comparing curves with the same total delay time.

NT-20 NANOTEM CALIBRATE SETUP

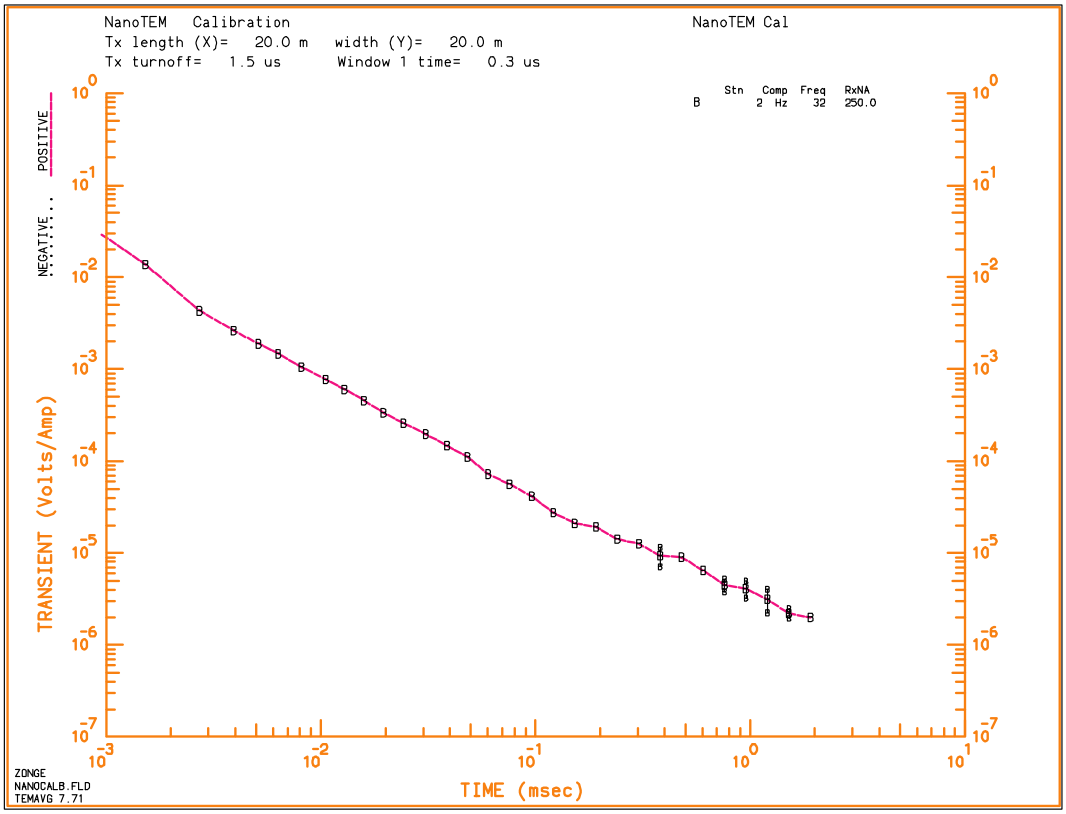


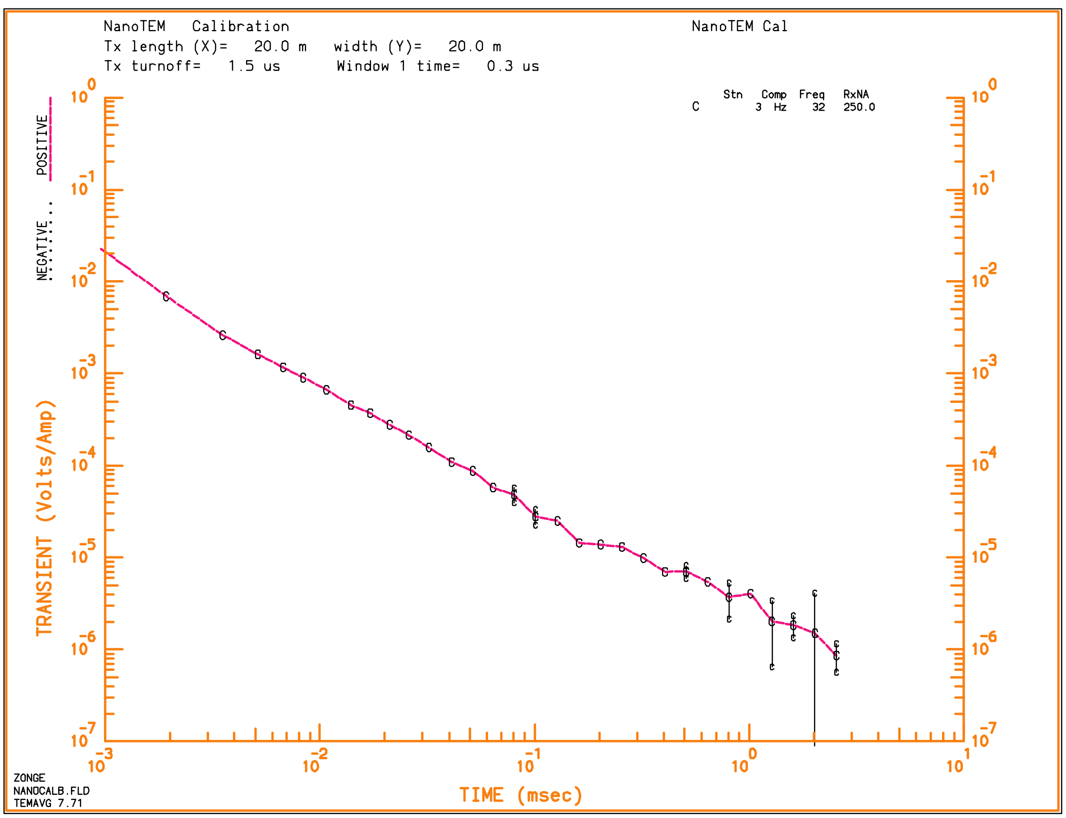
NT-32 NANOTEM CALIBRATE SETUP



NANOTEM CALIBRATOR DECAY TRANSIENT

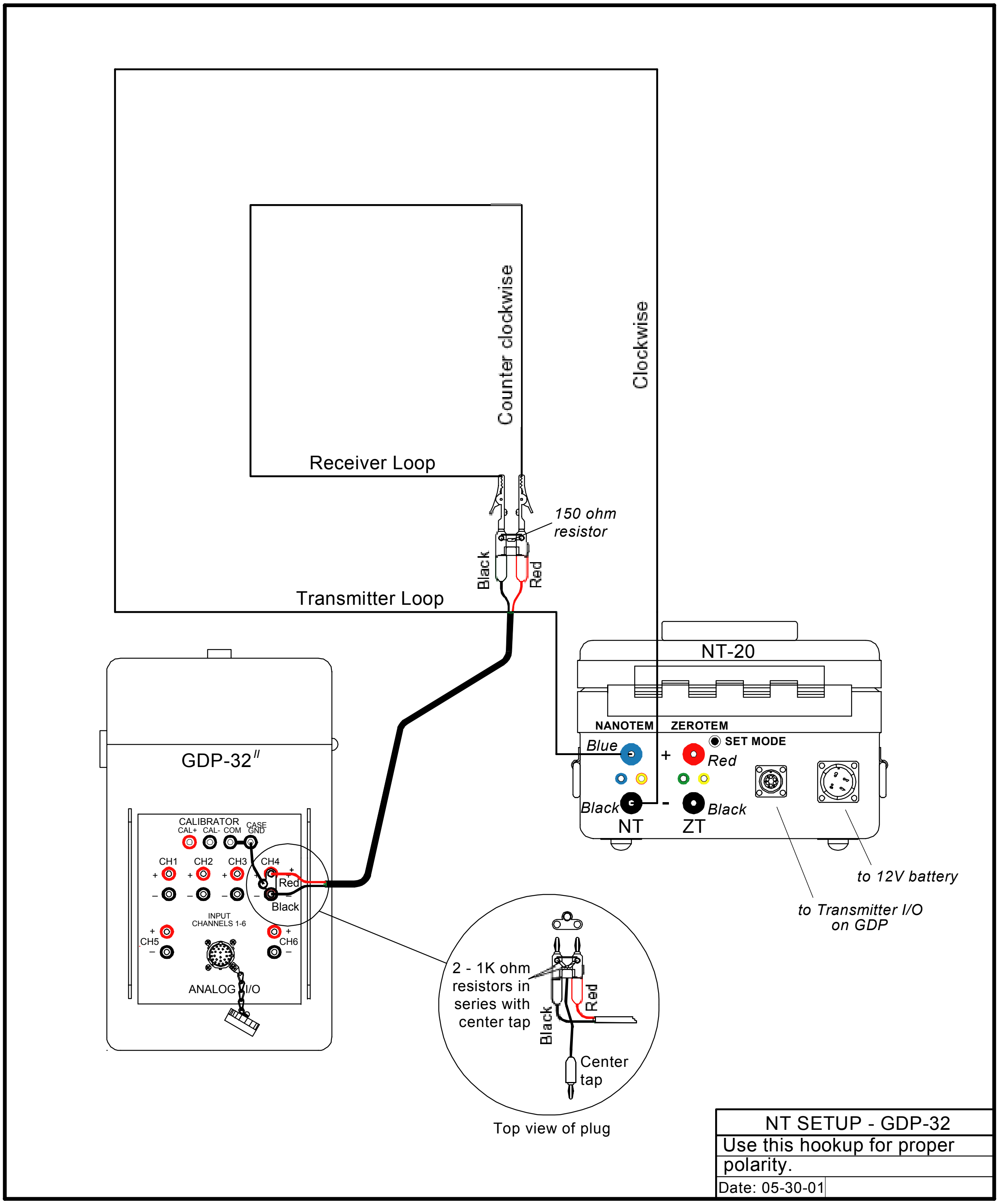
A (top): 1.2 us sample interval, ***B*** (bottom): 1.6 us sample interval.



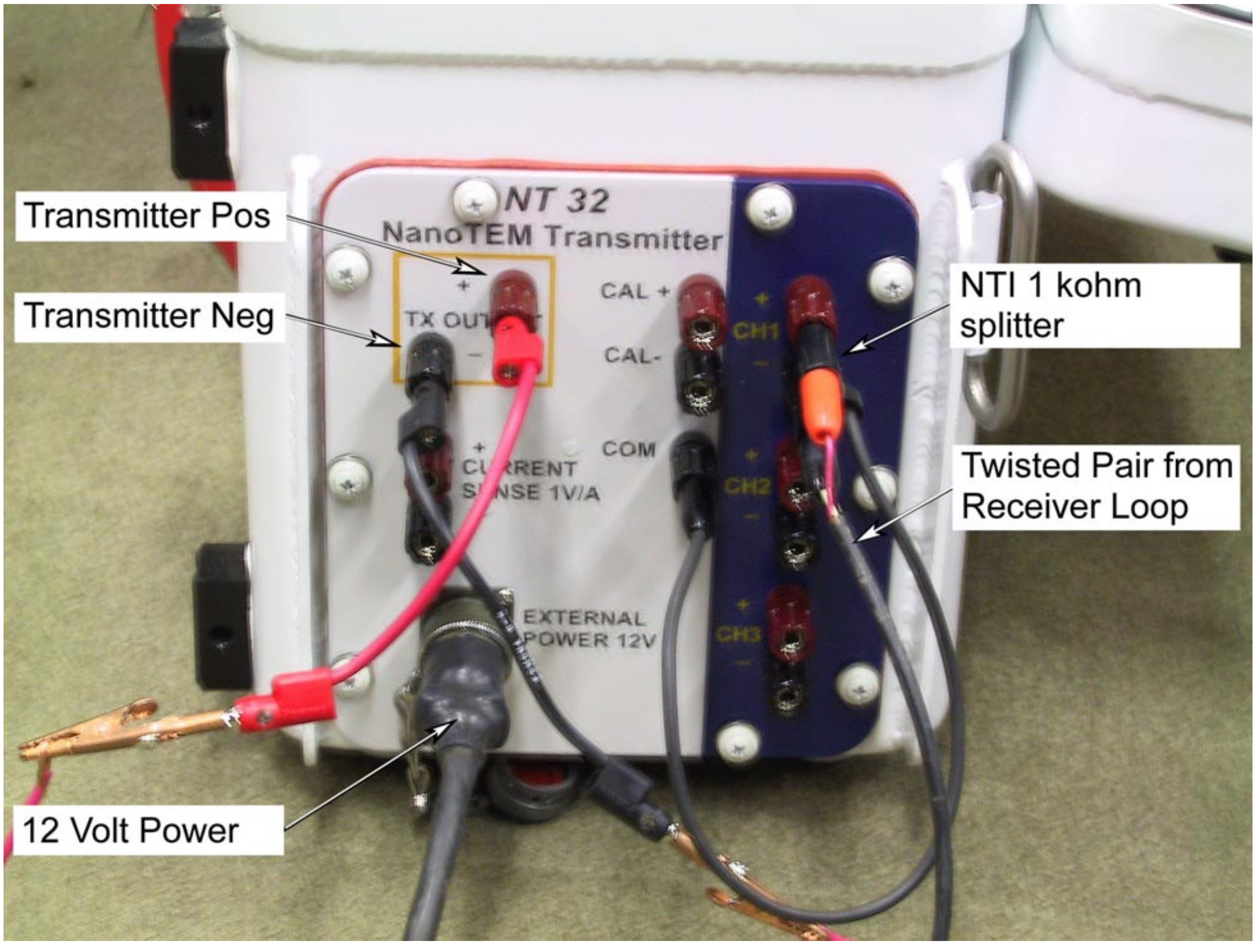


19.9 NANOTEM FIELD SETUP

NT-20 FIELD SETUP



NT-32 FIELD SETUP



19.10 EQUAL-INTERVAL MODE, NANOTEM

General

A version of the NanoTEM program that runs on the Zonge GDP-32^II receiver permits NanoTEM transients to be uniformly sampled and stored as time series to the hard disk. The window parameter may be toggled between **ZONGE STANDARD**, **SHALLOW** and **EQUAL INTERVAL** acquisition modes. The **ZONGE STANDARD** NanoTEM data acquisition modes are described in the NanoTEM sections of this manual. When the NanoTEM program is operating in the **EQUAL INTERVAL** mode, it writes **EQUAL** in the window parameter field in the data cache.

The program stores the first 31 samples of the transient time series to the data cache using a format identical to that of the NanoTEM program. However, the entire transient waveform that usually contains many more samples is written to a disk file whose name is **BLKnnnn.NTE** where **nnnn** is a 4-digit integer corresponding the GDP32^II block number of the data measurement. The transient data files are written in binary for efficient storage and data transfer. But they are easily transformed into ASCII text format using one of DOS executable utilities furnished when a receiver is purchased with this version of the NanoTEM program.

The NanoTEM Equal Interval program can handle a maximum of 65536 bytes of data. Since each sample point takes 4 bytes, the maximum number of sample points that can be acquired is 16384. Divide this number by the number of channels to determine the number of samples per channel that can be acquired.

Operating Instructions

With a few minor differences as explained below, the **EQUAL INTERVAL** NanoTEM program operates the same as the NanoTEM program.

MENU 1:

Select the **EQUAL INTERVAL** option by moving the cursor to the **WINDOWS** field and toggling between **EQUAL INTERVAL**, **SHALLOW**, and **ZONGE STANDARD** options. The remaining parameters are the same as in the standard NanoTEM program.

MENU 4:

In MENU 4 (the last menu before data are acquired) there are three parameter fields:

Width: This field is set to a sample interval of 1.2 µs.

Start: This field specifies the delay time in sample intervals from the logic time of current turn-off to the first sample of the transient. No corrections for transmitter delay filter delays antenna delays, or current turnoff times are applied. Delays of 1 through 99 are permitted.

Count: This field specifies the number of samples to be acquired. The maximum number of samples is 4096.

Data Inspection and Downloading

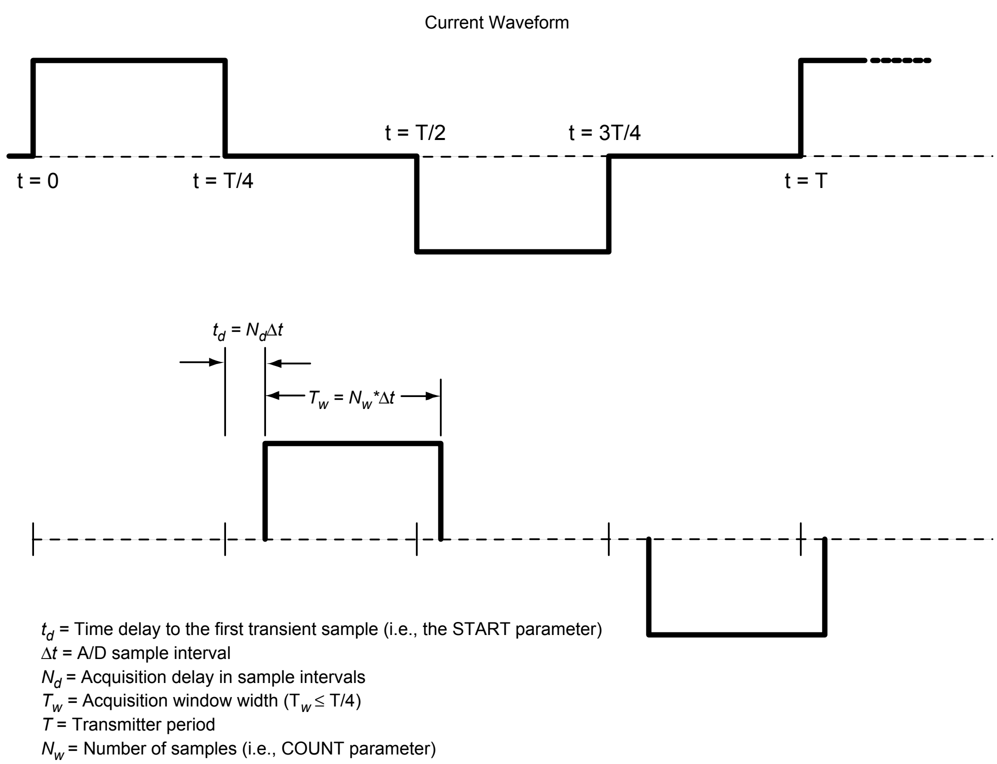
The sampled data falling within the gates as defined above and illustrated in the accompanying figure are rectified and stacked. These data are stored both in the data cache and as binary files on the hard disk. Only the first 31 data points are stored in the cache. They may be viewed and/or dumped from the DATA menu using procedures common to all the programs. The binary files are stored on the hard disk with the name **`BLKnnnn.NTE`**, where **`nnnn`** is an integer corresponding to the block number of the corresponding partially complete data set stored in the data cache.

The binary data may be downloaded using either the LAN connection or the serial port. The steps for downloading are listed below:

1. While the GDP-32^{II} power is off, connect it to either a LAN or to the serial port of another computer (a null modem must be used).
2. Turn on the GDP-32^{II} and run Windows.
3. If using the LAN, you may have to re-configure the network parameters in the GDP-32^{II} to be compatible with your network.
4. If using the serial port, HyperTerminal is the recommended program to use. You will have to ensure that the two serial ports are configured identically.
5. The data files are stored in **`d:\data\`**.

Binary data files with the extension **`.NTE`** may be inspected by converting them to ASCII format. The utility program **`TEMASCII.EXE`** converts a binary file to an ASCII text file of the same name with extension **`PRN`**.

The source code for this utility program is included so that users or customers have prototype C code for reading a binary file containing uniformly sampled transient data.



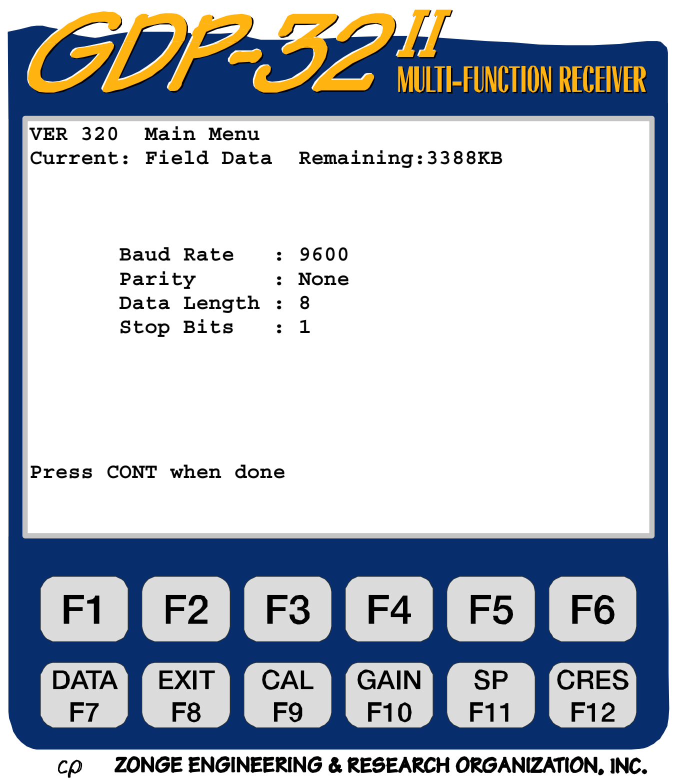
Explanation of the EQUAL INTERVAL mode data acquisition mode in the GDP-32^{II} TEM program

19.11 CONFIGURING PORTS

SERIAL I/O PARAMETERS

Option 3 of the Data Mode Main Menu sets the protocols for transferring data to a computer via the RS-232 serial port. The GDP-32^II uses a standard XON, XOFF software handshake protocol. For complete information on transferring data see ***Section 19.12 below***.

1. From the Main Data Menu, press # 3. The ***Configure Serial Port Options*** Menu appears:



2. Use SELECT UP Home and SELECT DN End to set the four parameters.
   - The default Baud Rate is 9600. Most computers accept this transfer rate. This transfer rate may need to be decreased for some modems. Available Baud Rates range from 300 to 38,400.
   - The default Parity is NONE. The GDP-32^II also accepts EVEN or ODD parities.
   - Data length default value is 8 bits.
   - Stop bits default is 1.
3. Once the parameters have been set, press CONTINUE Enter to return to the Data Mode Main Menu.

PARALLEL PORT MODE

Option 4 of the Data Mode Main Menu enables or disables the parallel port for transferring cache data to a printer. The current port status is displayed above the Data Mode Main Menu:

`Parallel Port Disabled`

NOTE: Before the parallel port can be enabled the GDP-32^{II} must be connected to an on-line printer via the parallel port.

1. Connect the GDP-32^{II} parallel port to the printer using a Zonge Parallel Cable.
2. Turn the printer on.
3. Press [$ 4] from the Data Mode Main Menu to enable the parallel port.
4. The receiver returns to the Data Mode Main Menu and displays the current port status:

   `Parallel Port Enabled: ready`

5. See ***Section 19.12*** for complete instructions on transferring data. ***When data transfer is complete, disable the parallel port.***

19.12 OUTPUTTING DATA

OUTPUT TO A COMPUTER

The GDP-32^{II} stores 2 to 10 days' worth of data in memory. Zonge Engineering recommends that you dump data to an external computer at the end of every day in the field. Data are dumped to a computer using a serial dump cable for the data transfer procedure listed below. Before outputting data, be sure to check the Serial Port configuration (see ***Section 19.11 above***)

1. Attach the Serial I/O Cable between the serial port of the GDP-32^{II} and the serial port connector on your computer. This cable has a military plug at one end and a standard RS-232 9- or 25-pin D-connector at the other end.
2. Start the file transfer program on the computer (such as HyperTerminal).
3. Open a data file on the computer (e.g. for HyperTerminal: Transfer / Capture Text). The data will be sent from the GDP-32^{II} into this file.
4. Verify that the program is connected with the receiver.
5. On the GDP-32^{II}, press [DATA F7] to enter Data Mode. Press [STOP AVG Escape], [STOP AVG Escape] to access the Data Mode Main Menu.
6. Press [! 1], Access Cache.
7. Select the cache you wish to dump (e.g. press [! 1] for Field Data, etc.) In the Field Data cache some or all of the data can be output. For board or antenna calibration data the entire contents of the cache are dumped.
8. Immediately upon selecting the output mode, the receiver begins transferring data. The receiver LCD displays:

   ```
   Transmitting
   x blocks found to transmit
   ```

   Check this last message to make sure all the blocks selected are transmitting.
9. When the output is initiated, the data scrolls onto the computer display.
10. If the GDP-32^{II} outputs data faster than the computer can accept it, the screen displays:

    ```
    Waiting
    ```

    as the data transfer stalls until the computer catches up.
11. When transfer is complete, the data stops scrolling on the computer terminal. The GDP-32^{II} LCD displays the Cache Menu.
12. Close the data file on the computer (e.g. for HyperTerminal: Transfer / Capture Text / Stop).
13. Exit the computer file transfer program.
14. Check the new file for garbled or missing data before assuming that this process is complete. Verification consists of noting the number of data blocks in the GDP-32^{II},

verifying that all blocks are transferred to the computer, and verifying that all blocks are readable, complete, and have a standard format.

15. Make back-up copies of all data on floppy disks.
16. Once all data is saved, initialize the data cache in the receiver

OUTPUT TO A PRINTER

Cache data is output to a printer via the parallel port. Usually data is transferred to a computer, but there may be occasions when a printout is all that is necessary.

1. In order to output data to a printer, the parallel port must be enabled. Follow the instructions in ***Section 19.11*** to enable the parallel port.
2. Press **DATA F7** to enter Data Mode.
3. Press **STOP AVG Escape**, **STOP AVG Escape** to access the Data Mode Main Menu.
4. Press **! 1**, Access Cache.
5. Select the cache to output.
6. As soon as the output mode is selected, the receiver begins transferring data to the printer. The receiver LCD displays:

   `Transmitting`

   `x blocks found to transmit`

   Check this last message to ensure that all of the selected blocks are being transmitted.
7. If the GDP-32^{II} outputs data faster than the printer can accept it:

   `Waiting`

   is displayed as the software handshake takes over until the printer catches up.
8. When the transfer is complete, the data stops printing and the GDP-32^{II} returns to the Data Mode Main Menu.
9. Examine the printed output to ensure the data have transferred correctly.

NOTE: When finished printing data via the parallel port, reset the port status. If the parallel port is not disabled and a data transfer is initiated through the RS-232 port, the system will freeze. If this happens, re-boot the receiver by pressing **`Control – Alt – Delete`**.

SIMULTANEOUS OUTPUT TO COMPUTER AND PRINTER

Data can be output to both a computer and a printer simultaneously.

1. Enable the parallel port. (***See Section 19.11***) Follow the instructions for outputting data to a computer.
2. The data will output to the computer and printer at the same time.

OUTPUT TIME SERIES DATA VIA NETWORK

Time Series data are stored as files on the hard disk (drive D:). These files can be accessed and transferred using Windows Explorer. When the GDP-32^{II} is connected to a Local Area Network, any other computer on the network can also see the GDP hard drive. File transfer is now facilitated by dragging and dropping files on the GDP to any desired folder on any other computer.

NOTE: Program files and cache files can also be transferred this way.

To transfer time series files:

1. Turn OFF the GDP.
2. Connect the GDP-32^{II} to the LAN using the multi-function interface cable.

   NOTE: This is a special cable supplied by Zonge Engineering (P/N: GDP-32/2-ACC).
3. Start the GDP and get into Windows.
4. The GDP-32II is configured by default to have no password. It is also set to obtain its IP address automatically. It's name is set to appear as: GDP32IISNxx, where xx is the front panel serial number. It's default workgroup is "ENGINEERING".
5. Once Windows is running, the GDP-32^{II} should appear in the Network Neighborhood of the other computers on the network. Now you can easily transfer files to other computers.

   NOTE: The time series files are stored in the directory **`D:\DATA`**.
6. Exit Windows on the GDP as you would any other computer.