Kantronics **Telemetry Unit**

Weathernode

Operator's Manual

Kantronics
RF Data Communications Specialists

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The KTU with Weathernode is a Kantronics hardware and software design.

We have attempted to make this manual technically and typographically correct as of the date of the current printing. Production changes to the KTU with Weathernode may add errata or addendum sheets. We solicit your comments and/or suggested corrections. Please send to Kantronics Co., Inc., 1202 E 23rd Street, Lawrence, KS 66046.

Printed in the U.S.A.

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Warranty

To be sure you will receive notice of future updates or new product information, please take a moment to complete the warranty registration card and return it to us.

We do need your warranty registration on file.

Kantronics Co., Inc. warrants each KTU to be free from defects in material and workmanship under normal use and service for a period of one year from date of purchase by the ultimate user. Kantronics will repair or replace the KTU at our option, at no charge, should it become defective and should our examination disclose the KTU to be defective under warranty. Kantronics sensors are warranted for ninety (90) days from date of purchase.

This warranty shall not apply to any unit that has been subject to misuse, neglect, accident due to wiring not of our own installation, to use in violation of instructions furnished by Kantronics, or any other cause beyond our reasonable control. This warranty will not be extended to units that have been repaired or altered outside our facilities.

This warranty does not cover broken or cracked cases or any accessory used in connection with the KTU. This warranty is in lieu of all other warranties expressed or implied. No representative or person is authorized to assume for Kantronics any other liability in connection with the sale of its products.

Precautions

The sensor inputs to the Kantronics Telemetry Unit (KTU) are protected against continuous inputs up to 50 volts. If you are installing this in a location that may be subject to higher voltage spikes, you should install appropriate protection on the sensor leads.

The K2, K3, K4, K5, K6 and K7 headers are provided to allow for future add-on boards. Do not place jumpers on any of these pins.

Climbing on your roof can be hazardous (use common sense). If you are uneasy about installing your accessories, please have a qualified professional complete the installation. Kantronics specifically disclaims any liability for any injury or loss resulting from the installation or use of the accessories.

Lithium batteries should not be incinerated.

Return/Repair Procedures

Consult the limited warranty policy in this manual for the service provisions offered by Kantronics at no charge. This warranty is considered to be in force only when the customer has submitted his completed warranty registration within 10 days of purchase, and when the stipulations of the warranty have been met. Violations of warranty clauses will automatically void the warranty and service or repairs will be charged to the owner.

Service outside the warranty will be charged at the cost of parts, labor, and return shipping. Repaired units will be returned via UPS C.O.D. These C.O.D. charges can be avoided by including your VISA or MasterCard number with your unit to be repaired. Shipping and repair may then be charged.

When service or repairs appear necessary, it may be wise to call or write Kantronics to determine if the problem can be solved without returning the unit. Should you encounter difficulty in getting your KTU to "talk" to your computer, you may wish to perform some limited checks before calling or writing. Carefully check your wiring connections to the RS-232 port. Verify your terminal baud rate. It may be useful to perform a "Hard Reset". (See Hard Reset section.)

When calling, report the product name and ask for the Amateur Radio Service Department. Should you find it necessary to call for assistance, please have the following information available:

1. The unit name and serial number (the serial number is found on the rear panel.)

2. The firmware version number (the version number is displayed with the sign-on message of the KTU.)

If possible, you should have the KTU and your computer available to perform troubleshooting operations when you call.

The Service Department telephone hours are 9 am - noon and 2 pm - 5 pm Central Time 913-842-4476, Monday through Friday.

When writing, include a clear description of the problem, unit name, computer type, computer software used, TNC type and if possible a DISPLAY listing from the KTU and the TNC.

Returns to the factory for refund or exchange are strictly regulated. Any return for refund or exchange must be approved by the service department.

Radio Frequency Interference Statement

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital Device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiated radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that the interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced Radio/TV technician for help.

The user is cautioned that any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

RFI Suppression

In moving to the world of digital communications via computers, a new dimension of RFI may be encountered. In spite of the equipment manufacturers' diligence, each new piece of electronic equipment will react differently in each separate environment. Every amateur station will have its own unique layout, equipment variation, and antenna installations. Experience has shown that these differences are related to the total RF environment, and may be causative factors in RFI induced problems. The suggestions given here may assist in resolving RFI problems you may encounter in your "unique" station.

1. Use shielded cable for all connections between equipment.

2. Make all interconnecting cables as short as practical. A balance should be maintained between cable length and equipment proximity. At times simply moving the video monitor one foot further from an interface or other device will solve the "screen hash" problem.

3. Antenna runs should be kept away from equipment control lines and/or interconnecting cables. If it is necessary for such lines to cross each other they should do so at 90 degree angles.

4. Ground leads should be as short as possible and go to a GOOD EARTH GROUND.

5. Interconnecting cables appearing to act as radiators or antennas should be looped through a toroid. Be certain toroids, if used, are designed for the frequency in use.

Introduction

Congratulations on purchasing the Weathernode, the Kantronics Telemetry Unit (KTU) with installed Weathernode EPROM. The Weathernode, along with various optional sensors, is designed to gather, store and then provide, on demand, local area weather conditions to your local packet network via your TNC. The Weathernode may be installed at your station between your TNC and computer. Then, as systems operator (sysop), you have direct access to these weather data, the KTU for programming (setting up) the Weathernode, or looped-through access to your own TNC for basic packet operation.

The Weathernode supports five sensors, a PC board mounted temperature sensor, an external temperature sensor, wind speed, wind direction, and a rain gauge. The temperature sensors are supplied with the unit. The anemometer (for wind speed and wind direction) and the rain gauge are options available from your dealer.

The owner of the Weathernode, as sysop, determines how often each sensor is sampled and sets a program into the Weathernode to begin the sampling of data. Depending on the frequency and the number of sensors sampled, data may be stored for several days. Any user of the Weathernode can then access these data using the DATA command from any remote TNC via packet.

The Weathernode may be placed in remote areas along with just a TNC and transceiver to provide weather data. It incorporates a clean power interrupt circuit to insure proper return to operation (preserved data) after power fluctuations.

Throughout this manual references to the KTU refer primarily to the hardware while references to the Weathernode refer to features supported by the firmware (the EPROM). While the Weathernode is shipped to support weather activities, it is possible to attach some additional sensors, custom designing your own version of the Weathernode. Additionally, the KTU, with a different EPROM program or with modified use of the existing weather EPROM, may be used for other data gathering purposes. Use your own imagination. Refer to the appendices on how to work with additional sensors.

User's Guide

Copy this page (front and back), and give it to your users!

A Kantronics Weathernode is now installed in our local area. The Weathernode records statistics concerning local conditions, and you can access that information from your own TNC and packet station.

The information being collected by the Weathernode is indicated by a check mark in the appropriate box:

- ❑ Printed Circuit board temperature (TP)
- ❑ Outside temperature (TF)
- ❑ Wind Speed (WS)
- ❑ Wind Direction (WD)
- ❑ Rain Gauge (RG)
- ❑ Other _____

  _____

  _____

In order to use the Weathernode, connect to _____.

- ❑ Once connected, you will receive a prompt from the Weathernode, indicating it is ready for your commands.
- ❑ This will connect you to a Net/Rom or TheNet node. Next you must send a CONNECT to the node (do not specify a callsign). This tells it to connect to the Weathernode. You will then receive a prompt from the Weathernode indicating it is ready for your commands.

  Net/Rom and TheNet nodes can only accept 6 lines of data from the serial port at a time. As a result, you will not be able to receive a full HELP description for commands. Contact your sysop if you need more information on the Weathernode commands.

The Weathernode prompt is:

wxn:

The commands available to you are:

B(ye)	Disconnect from the Weathernode
H or ?	Display a help table of user commands
D(ata)	Retrieve data from the Weathernode.
DM(etric)	Retrieve data using metric units.
DU(sa)	Retrieve data using US units.
HELP	Display a complete list of all Weathernode commands. Most of these are for display only, you can't change them.
HELP D	Provides a full help description of the DATA command.
PR(ogram)	Display the sampling program in the Weathernode.

The DATA, DMETRIC, and DUSA commands are used to display readings stored in the Weathernode. The sysop has set the Weathernode to display all values in:

❑ US units (inches, mph, etc) ❑ metric units (cm, kph, etc)

If you specify the DATA command, you will receive values in these units. If you specify DUSA or DMETRIC, you will receive the values in the appropriate units. All of these commands have the same format, allowing you to specify what you want to see. The format of the DATA command is:

DATA [[sensor] [n[step]] [START ddhhmm]] ...

where:

sensor is the specific sensor desired. If none is specified, all programmed sensors will be displayed.

n is the number of samples you wish to display. If this is not specified, one sample is displayed.

step is the increment between samples. If you wish to specify step, you must specify n greater than 1. Step 2 would cause every other stored sample to be displayed.

START is a keyword and allows you to specify the earliest sample you want to see. You must then specify a start time in the format ddhhmm where dd is the day (01-31), hh is the hour (00-23) and mm is the minute (00-59).

Examples:

DATA TF 3 WS 5 2 WD 2 2 RG 3
would display 3 readings of temperature, 5 readings of wind speed, 2 readings of wind direction, and 3 readings of the rain gauge. The wind speed and wind direction readings would be every other sample (step 2). All readings would start with the most recent reading.

DATA 5 2
would display 5 readings of all sampled sensors, and every other sample would be displayed.

DATA TF WS 3
would display one reading of the external temperature sensor, and 3 wind speed readings.

DATA 5 START 011830
would display 5 readings of all sensors, with the oldest reading being as close to 6:30 pm (1830) as possible on the 1st of the month (01).

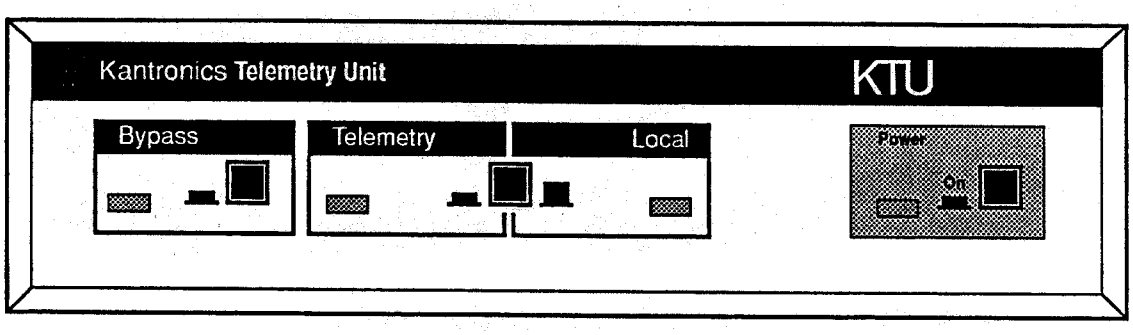
In order to find out how often the sensors are being sampled, just give the PROGRAM command. The Weathernode will return its program, along with the number of samples it can store, and the total number of days, hours and minutes worth of samples that will be stored. A typical program might be:

PROGRAM R8H RG R10M TP TF A5M WS WD

This means that the Weathernode will record (R) every 8 hours (8H) the rain gauge (RG), every 10 minutes (10M) the PC board temperature (TP) and external temperature (TF), and also average (A) every 5 minutes (5M) the wind speed (WS) and wind direction (WD).

When you are through obtaining information, you may disconnect from the Weathernode in one of two ways. If you issue the BYE command, the Weathernode will disconnect from you. You may, instead, place your TNC in command mode, and issue the disconnect yourself.

Front Panel



Bypass LED (Red) – When the BYPASS switch is depressed, this LED will light, indicating that the KTU is in the BYPASS mode, connecting your attached terminal to the TNC. The BYPASS switch must be in the OUT position for KTU operation to either the TNC or the terminal.

Bypass Switch – With this switch pushed in, the KTU is in the BYPASS mode, and the terminal attached to the COMPUTER port is directly connected to the TNC, bypassing the KTU completely.

Telemetry LED (Yellow) – This LED indicates that the KTU is communicating with the attached TNC. This is controlled by a combination of two switches – the BYPASS switch must be OUT, and the Telemetry/Local switch (between the Telemetry and Local LEDs) must be pushed IN.

Telemetry/Local Switch – The BYPASS SWITCH must be in the OUT position for this switch to have any effect. When this switch is depressed, the KTU will be connected to the TNC for input and output. With this switch in the out position, the KTU will have its input and output connected to the attached terminal.

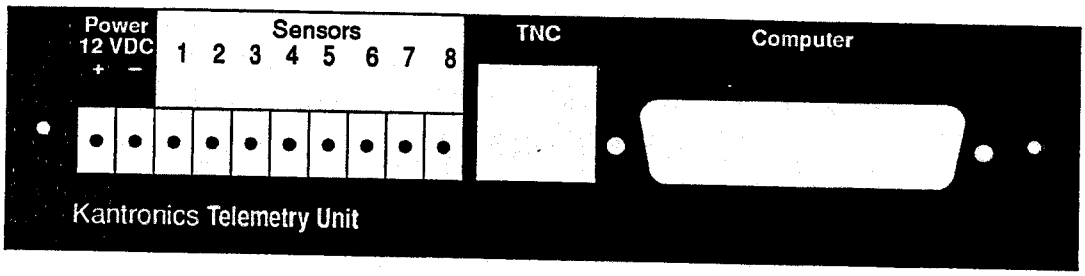
Local LED (Yellow) – This LED indicates that the KTU is communicating with the attached Terminal. This is controlled by a combination of two switches – the BYPASS switch must be OUT, and the Telemetry/Local switch (between the Telemetry and Local LEDs) must be OUT. This mode is used to program the KTU from your terminal, or to retrieve data readings locally.

Power LED (Green) – This LED will illuminate when power is applied.

Power Switch – This switch provides power control for the KTU. When depressed, power is applied to the KTU from the Power +12 VDC connector on the rear panel.

NOTE: Jumper J9 on the KTU circuit board is provided to disable ALL LEDs. With the jumper removed, no LEDs will light (not even the power LED). In this mode, the KTU will require approximately 30 ma @ 12 VDC. With the LEDs enabled, the KTU requires approximately 45 ma.

Back Panel



Power – The supplied power cable will plug into the rear panel terminal strip marked Power and connect to your 12 volt DC power supply.

Sensors – The terminal strip marked Sensors is used to connect external measuring devices (sensors) to the KTU. The supplied temperature sensor is preconnected to a mating plug to connect to this strip. To connect the optional anemometer or rain gauge to the KTU refer to Connecting sensors to your KTU. For information on other sensors, refer to Appendix B.

TNC – This jack is used to connect your TNC to the KTU using the supplied cable.

Computer – This jack is used to connect your computer to the Weathernode for local programming or local access.

Connecting sensors to your KTU

As shipped from the factory, your KTU is programmed to accept one temperature sensor (supplied), one anemometer with wind speed and wind direction sensors (optional), and one rain gauge (optional). These sensors connect to the KTU through the rear panel connector marked "Sensors". The pins on this connector are defined as follows:

Pin	Purpose
1	Ground
2	Wind Direction
3	Temperature sensor
4	Ground
5	Ground
6	Wind Speed
7	Rain Gauge
8	+5 volts DC (for sensors)

Temperature Sensor

The temperature sensor shipped with the KTU is pre-wired to the mating connector, ready to plug into the KTU. If for some reason, you must disconnect the sensor (i.e. extend the cable). Be sure to reconnect the temperature sensor as indicated below.

Temperature sensor wire	Pin
Shield	5
White	8
Red, Black, or Green	3 (depends on cable vendor)

Be sure to connect a 10µf capacitor between pin 3 (+) and pin 4(–) to insure sensor stability.

Anemometer

If you purchase the Kantronics Anemometer, the kit will include two 3.5 mm stereo jacks, with pigtails attached (wires prestripped). One of these jacks has two wires (black and orange), and the other has three wires (black, yellow, and blue). Connect the jack with three wires as follows:

Black to pin 1
Yellow to pin 2
Blue to pin 8

This jack will connect to the wind direction plug from the anemometer (marked with blue tape).

Take the other jack (with two wires) and connect the black wire to pin 5 and the orange wire to pin 6 of the KTU. This will connect to the other plug from the anemometer for wind speed reading.

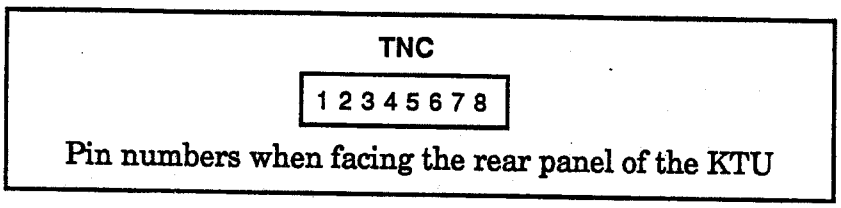
Rain Gauge

If you purchased the Kantronics Rain Gauge, the kit will include a 3.5 mm stereo jack, with pigtails attached. Connect the black wire to pin 5 and the red wire to pin 7 of the KTU.

Connecting the KTU to your station

The Kantronics Telemetry Unit (KTU) is shipped with a pre-wired cable which has a RJ-45 modular connector on one end, and a DB-25 connector on the other end. To connect the KTU to your TNC, first disconnect any connector attached to the serial port of your TNC, and plug the DB-25 connector on the supplied cable into your TNC. Plug the modular connector into the receptacle on the rear panel of the KTU labeled TNC. Next, connect the cable that you removed from the TNC (the cable from your terminal) into the DB-25 connector on the KTU (labeled COMPUTER). Note that if your TNC and computer are using TTL levels for the serial port instead of RS-232C levels, you must move jumper J8 in the KTU to the TTL position.

For those who may need special cables, the jack labeled TNC is a modular connector wired according to the following chart. Pins on the connector are numbered left to right as you look at the rear panel. A pre-wired cable is available from Kantronics to connect the KTU to the Data Engine.



Pin numbers when facing the rear panel of the KTU

KTU Pin RJ-45	Purpose	TNC Pin DB-25	TNC Pin DB-9
1	unused	n/a	n/a
2	DCD	8	1
3	note 1	n/a	n/a
4	GND	7	5
5	RxD	3	2
6	TxD	2	3
7	CTS	5	8
8	RTS	4	7

Note 1: Pin 3 of the KTU may be connected to a source of +12 volts DC to supply power to the KTU. In order to use this pin for power, you must place jumper JP6 on both posts. If you are connecting to a Kantronics KPC-2, KPC-2400, or KAM, this power may be provided from pin 25 of the TNC.

The DB-25 connector on the rear panel is used to connect your computer or terminal to the KTU for local access. The wiring on the DB-25 is standard RS-232C wiring as follows:

KTU DB-25	Purpose	Computer DB-25	Computer DB-9	
1	FG	1	5	(not required)
2	TxD	2	3	
3	RxD	3	2	
4	RTS	4	7	
5	CTS	5	8	
6	DSR	6	6	
7	SG	7	5	(same as pin 1)
8	DCD	8	1	
20	DTR	20	4	

Setting the KTU parameters

Before applying power to the KTU set the front panel switches as follows:

BYPASS	OUT
Telemetry/Local	OUT

The local light should now light when you turn the unit on, indicating that you can communicate with the KTU from your attached terminal. Set your communications program or terminal for 8 bits, no parity, and select a baud rate that matches what your TNC is using.

The KTU will perform its autobaud routine. When you see the message "PRESS (*) TO SET BAUD RATE", press the asterisk key on your keyboard. The KTU will now send its sign-on message:

```
KANTRONICS TELEMETRY UNIT
WEATHER NODE EPROM Vx.xx
(C) COPYRIGHT 1990 KANTRONICS INC.
ALL RIGHTS RESERVED
ENTER DAYTIME (YYMMDDHHMMSS)
wxn:
```

After you receive the wxn: prompt, you must set the date and time into the unit. See the DAYTIME command in the Commands section for details.

The next step is to program the Weathernode to sample the attached sensors. This is accomplished with the PROGRAM command. For instance:

```
wxn: PROGRAM R1M TP TF A1M WS WD
```

The Weathernode will respond with the total number of samples that can be stored and the amount of time required to obtain that many samples. As soon as you have set the program, the KTU will begin collecting samples from the attached sensors.

At this point, you may check the operation of the Weathernode from your attached terminal by using the DATA command. For instance, after the Weathernode has been running for a few minutes, you could issue the command:

```
data
```

and the Weathernode will show you the last reading it has taken for each sensor defined in the PROGRAM. (See PROGRAM and DATA commands in the Commands Section for full details.)

There are several commands that must be set in the Weathernode in order for it to operate properly when connected to a TNC. Those commands are listed below, with the proper value:

FLOW	OFF
ABAUD	XXXX (Match to your TNC serial port speed)
SCREENL	0
RTEXT	(This is your remote sysop password string)
ECHO	OFF
AUTOLF	OFF

In addition, if you want to allow multiple connects at the same time, you must set the following:

STREAM	ON
STREAMSW	(put the value of your TNC streamsw or chswitch character(s) in this parameter.)

If you are connecting the Weathernode to a Net/Rom or TheNet equipped TNC, you must have the following parameters set:

STREAM	OFF
NETROM	ON
FLOW	OFF
ECHO	OFF
AUTOLF	OFF
COMMAND	$1B (If you have changed the default Command character in the Net/Rom or TheNet node, this needs to match the node.)

Setting up your TNC for Weathernode Operation

Before putting your KTU on-line with a TNC, you must set certain parameters in your TNC. In order to set these parameters, set the BYPASS switch to the IN position (RED BYPASS LED lights). This allows your terminal to talk directly to the TNC.

The following lists show the required and/or recommended settings for best operation. The commands marked with an asterisk (*) are required, others are optional.

Kantronics TNCs

*8BITCONV	ON
*AUTOLF	OFF
CHECK	30
*COMMAND	$03 (TNC and Weathernode must be the same)
*CONMODE	CONV
CPACTIME	ON
*CR	OFF
*ECHO	OFF
*FLOW	OFF
*MCON	OFF
*MON	OFF
*NDMON	OFF (Version 2.85 or earlier)
*NEWMODE	OFF
*NOMODE	OFF
PACTIME	AFTER 3
*PARITY	4
*PASS	$16
*PASSALL	OFF
*PBMON	OFF (Version 2.85 or earlier)
*RELINK	OFF
SCREENL	0
SENDPAC	$7F
*STREAMCA	OFF
*STREAMDB	OFF (Version 2.85 or earlier)
*STREAMEV	OFF (See below)
*TRACE	OFF
*USERS	1 (See below)

Other TNCs

*8BITCONV	ON
*AUTOLF	OFF
*AWLEN	8
CHECK	30
*COMMAND	$03 (TNC and Weathernode must be the same)
*CONMODE	CONV
CPACTIME	ON
*CR	OFF
*ECHO	OFF
*FLOW	OFF
*MCON	OFF
*MON	OFF
*NEWMODE	OFF
*NOMODE	OFF
PACTIME	AFTER 3
*PARITY	0

*PASS	$16
*PASSALL	OFF
*RELINK	OFF
SCREENL	0
SENDPAC	$7F
*TRACE	OFF
*USERS	1 (See below)

If you want to support multiple connections, you must also set USERS greater than 1, and turn STREAMEV ON. If only one user at a time is desired, set MAXUSERS 1 for single port TNCs; for the KAM or KPC-4 set MAXUSERS 0/0. If you are using the Data Engine, set INTERFACE BBS and MAXUSERS 1/1.

If you experience problems setting up the Weathernode with a non-Kantronics TNC, you may call our factory for assistance, but you MUST have your TNC manual available, and a printout of your current parameter settings for both the TNC and the Weathernode.

Once you have set all of the parameters in the TNC and the Weathernode properly, you are ready to place your Weathernode on-line, for access by your local packet users.

To do this, set the BYPASS switch in the OUT position (RED BYPASS LED is not lit), and set the Telemetry/Local switch in the IN position (YELLOW TELEMETRY LED is lit). Your local keyboard will not have any effect, as it is effectively disconnected from the system.

You may now connect to the Weathernode from a remote packet system to test the operation of your Weathernode.

If using a Net/Rom or TheNet equipped TNC, you must enable host connections. This is normally accomplished with the command ESC Y1.

Assembly and Disassembly of the KTU

Should you require access to the Kantronics Telemetry Unit to reposition jumpers or for other purposes, disassemble as follows:

1. Turn off power to your KTU and remove all cables from the unit.

2. Using a small Phillips screwdriver, remove the two rear-panel screws just far enough to free the panel and bezel.

3. Pull the rear-panel, bezel, and circuit board out of the case from the rear of the unit.

To reassemble, reverse the procedure above. You may wish to remove the front panel prior to inserting the circuit board into the case, as this is generally easier in lining up the LEDs.

Hard Reset

Whenever you change to a new version EPROM it will be necessary to perform a hard reset on your KTU. The EPROM is located in socket U15.

To perform a hard reset, remove the KTU from the case (see assembly/disassembly instructions), then slip a piece of paper under the battery clip. Leave the paper in place approximately 10 seconds, then remove the paper and reassemble the unit.

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● ?

immediate

This command will display a brief help table for all user (non-sysop) commands. It also displays information on how to obtain further help. This command is identical to the H command.

● **ABAUD** n (n = 0, 300, 600, 1200, 2400, 4800, 9600, 19200)

default detected baud rate

The parameter n sets the baud rate used for input and output through the serial port and the TNC port. If 0 is used, the Weathernode will run an autobaud routine upon power-up. This routine looks for a "*" character from the attached computer to set the baud rate. When the Weathernode detects the * from your computer, it automatically sets the ABAUD parameter to the speed detected.

See also: clear, reset

● **AVGSAMPL** n (n = 1 - 50) [10 millisecond increments]

default 1

This command sets the sampling interval for sensors being averaged. Each sensor which is specified for averaging by the PROGRAM command will be sampled every n*10 milliseconds. The average will be calculated at the interval specified by the PROGRAM command.

See also: program

● **AUTOLF** ON|OFF

default ON

When ON, a line feed is sent to the attached serial device (TNC or terminal) after each carriage return. This parameter should be set ON when overprinting occurs and the terminal being used does not automatically supply its own linefeed after a carriage return. When the Weathernode is placed in the Telemetry mode, the AUTOLF command is ignored and no linefeed is sent to the TNC after the carriage return.

● **BKONDEL** ON|OFF

default ON

When ON the sequence backspace-space-backspace is sent to the terminal when the DELETE character is entered. When OFF, the backslash character "\" is sent when the DELETE character is entered.

See also: delete

● **BYE**

immediate

The BYE command is used to disconnect from the Weathernode. If you issue the BYE command, the Weathernode will actually issue the disconnect, allowing you to use the STAY feature of some network nodes. Alternatively, you may place your TNC in command mode, and then you can issue the DISCONNECT command.

● **CANLINE** n (n = $00 - $FF)
default $18 (CTRL-X)

This command is used to change the cancel-line input editing command character. Typing a CANLINE character will cancel all characters received by the Weathernode.

● **CANPAC** n (n = $00 - $FF)
default $19 (CTRL-Y)

This command defines the character used to cancel all output from the Weathernode, or to re-enable output from the Weathernode.

● **CLEAR**
immediate

The CLEAR command will cause the Weathernode to completely erase all parameters and values except for the DAYTIME. The Weathernode will revert to its autobaud routine, and the sensor program must also be reentered. This command is not available through the SYSOP function.

See also: reset

● **COMMAND** n (n = $00 - $FF)
default $03 (CTRL-C)

This command sets the character used to return your TNC to the Command Mode from the Converse Mode. It must be set the same as your COMMAND character in the TNC.

● **DATA** [[sensor] [n[step]] [START ddhhmm]] ...
immediate

The DATA command is used to retrieve sensor readings from the Weathernode. The optional values (sensor, n, step, and START date/time) can be specified to select only specific sensors or specify the number of samples, and the step between samples to be displayed. If the DATA command is given without any arguments, the Weathernode will return the last reading for each defined sensor.

Valid sensors are tf (temperature of external sensor), tp (temperature of PC mounted sensor), ws (wind speed), wd (wind direction), and rg (rain gauge).

Specifying n will cause n samples of the preceding sensor to be displayed (If the sensor is left blank, n samples of all defined sensors will be displayed). If step is specified, n must be specified and the Weathernode will skip step–1 readings between the displayed values (i.e. step=2 displays every other reading, step=3 displays every third reading, etc).

You may optionally (as the last item on the command line) specify a START time, using the format START ddhhmm where dd is the day (01-31), hh is the hour (00-23) and mm is the minutes (00-59). The Weathernode will then display the requested data, starting at the date and time you have specified.

See also: dmetric, dusa, maxdata, metric

● **DAYTIME** yymmddhhmmss

If the parameter yymmddhhmmss is present, the software clock/calendar and hardware real-time clock (RTC) are set for timestamping of the sensor samples. If DAYTIME is entered with no parameter, the daytime is displayed in a form depending on the setting of the DAYUSA flag. For example, entering DAYTIME 900929201530 would indicate 1990, September 29, 20:15:30.

See also: dayusa

● **DAYUSA** ON|OFF

default ON

When ON, the daytime stamp is displayed in the form common in the USA: month/day/year. When OFF, the daytime stamp is displayed in the form common in Europe: day/month/year.

See also: daytime

● **DCDINVER** ON|OFF

default OFF

This command allows the Weathernode to operate with those TNCs whose Data Carrier Detect line (Pin 2 of the Weathernode Modular connector) is inverted as compared to the RS-232C standard.

● **DELETE** n (n = $00 - $FF)

default $08 (BACKSPACE)

This command sets the character to be used as the delete character. When this character is typed, the last input character is deleted. The most common settings are $08 (BACKSPACE) and $7F (DELETE).

See also: bkondel

● **DISPLAY** [c]

This command causes the Weathernode to display a list of all of the parameters. You may also display only selected parameters by specifying the appropriate class identifier for that group. When using the DISPLAY command with a class, be sure to use a space between the DISPLAY command and the class. Classes of related parameters are:

(A)sync	asynchronous port parameters (Weathernode to computer port and TNC port).
(C)haracter	special Weathernode characters
(T)iming	parameters affecting time
(W)eather	parameters affecting the Weather Sensors

● **DMETRIC** (See Data command)

This command retrieves weather data in the same format as the DATA command, but the values will be in METRIC units, regardless of the setting of the METRIC command.

See also: data, dusa

● **DUSA** (See Data command)

This command retrieves weather data in the same format as the DATA command, but the values will be in U.S. units, regardless of the setting of the METRIC command.

See also: data, dusa

● **ECHO** ON|OFF

default ON

When ON, characters received from the computer port are echoed back to the computer port. If you are receiving double print of characters you type on the keyboard, turn this command OFF. This corresponds to the setting in your terminal program for DUPLEX. If your program is set for full-duplex, set ECHO ON. If your program is set for half-duplex (some call it echo) then set ECHO in the Weathernode OFF. Regardless of the setting of this command, the Weathernode will not echo characters received from the TNC port.

● **ESCAPE** ON|OFF

default OFF

This command specifies the character which will be output to the terminal when an escape character ($1B) is received. When OFF, $1B is sent, this is useful if your terminal interprets ESC characters as screen positioning commands (ANSI). When ON, the escape character is sent as a dollar sign ($).

● **EXIT**

immediate

The EXIT command is used to exit the SYSOP mode of the Weathernode. Once you have successfully entered SYSOP mode, and wish to leave without disconnecting from the Weathernode, you should issue this command.

See also: sysop

● **FLOW** ON|OFF

default OFF

When FLOW is ON, any character entered from the terminal will halt output to the terminal until the current line is completed (by a carriage return). Canceling the current input to the Weathernode or typing the REDISPLAY-line character will also cause output to resume. FLOW will keep received data from interfering with data entry. When FLOW is OFF, received data will be interleaved with keyboard entry.

● **F1** 0|1

default 1

This command is used to toggle the F1 output from the KTU on (1) or off (0). The output appears on jumper J5, and may be routed to pin 7 of the P1 connector on the rear panel by placing the jumper on the center post and the left post, looking from the rear of the unit.

See also: f1freq

● **F2** 0|1

default 1

This command is used to toggle the F2 output from the KTU on (1) or off (0). The output appears on jumper J6, and may be routed to pin 8 of the P1 connector on the rear panel by placing the jumper on the center post and the left post, looking from the rear of the unit.

See also: f2freq

● **F1FREQ** f d (f = 10 - 4000, d = 1 - 99)

default 0 50

This command causes the F1 output from the KTU to output frequency f with duty cycle d.

See also: f1

● **F2FREQ** f (f = 1 - 4000)

default 0

This command causes the F2 output from the KTU to output frequency f. Any value may be entered, but the Weathernode will actually generate only those frequencies that are a multiple of 50 Hz, or can be divided into 50 (i.e. 2, 5, 10, 25). The Weathernode will choose the frequency closest to your entered value, and then set F2FREQ to the value actually generated.

See also: f2

● **H**

immediate

This command will display a brief help table for all user (non-sysop) commands. It also displays information on how to obtain further help. This command is identical to the ? command.

● **HELP**

immediate

Causes a display of all possible commands.

● **LCOK** ON|OFF

default ON

When ON, no character translation occurs in the Weathernode. If OFF, lower case characters will be translated to upper case before being output to the terminal.

● **MAXDATA** n (n = 1 - 255)

default 30

This command specifies the maximum number of samples that the Weathernode will send in response to a DATA command.

See also: data, netrom

● **METRIC** ON | OFF
default OFF

When OFF, sensor readings will be displayed in standard U.S. format (i.e. temperature in degrees Fahrenheit, wind speed in miles per hour and rain gauge in inches). When ON, the sensor readings will be displayed in metric units (i.e. temperature in degrees Celsius, wind speed in kilometers per hour and rain gauge in centimeters).

See also: data, dmetric, dusa

● **NETROM** ON | OFF
default OFF

This command enables the Weathernode to operate through the serial port of a Net/Rom or TheNet node. In this mode, you MUST set MAXDATA to 6 due to the way the Net/Rom node operates.

● **NUCR** n (n = 0 - 31)
default 0

This command determines the number of nulls sent to the terminal after a <CR>, in order to enable a transmission delay following any <CR> sent to the terminal. This is useful for some hardcopy terminals.

See also: nulf

● **NULF** n (n = 0 - 31)
default 0

This command determines the number of nulls sent to the terminal after a <LF>, in order to enable a transmission delay following any <LF> sent to the terminal. This is useful for some hardcopy terminals.

See also: nucr

● **PARITY** n (n = 0 - 4)
default 4

This command sets the Parity mode for output to the terminal and TNC according to the following table:

n	Parity
0	odd
1	even
2	mark
3	space
4	none (no modification)

The Weathernode will send serial output with 8 data bits and one stop bit. Setting the PARITY parameter defines the eighth bit. This command corresponds to the setting of parity in your communications program or TNC.

● **PROGRAM** type_interval sensor [sensor ...] [type_interval sensor ...]

This command is used to set the method of recording each sensor attached to the Weathernode and the time interval between readings. The type_interval parameter consists of two portions - a method of recording, and a time interval. The valid methods of recording are:

r record
This method records the current value of the sensor when the time interval expires.

a average
This method calculates an average of several samples taken since the last time interval expired. The time interval between the individual samples is set by the AVGSAMPL command.

The time interval portion of the type_interval parameter specifies how often the sensor is recorded into the log. It consists of a number and a unit. The valid units are:

s seconds
m minutes
h hours
d days

The sensors currently defined in the Weathernode firmware are:

tf External temperature sensor
tp PC Board mounted temperature sensor
ws Wind speed
wd Wind direction
rg Rain gauge

Example: In order to program the Weathernode to record the outside temperature every 5 minutes, average the windspeed every 5 seconds, and average the wind direction every 5 seconds, you would use the command:

PROGRAM R5M TF A5S WS WD

NOTE: You must specify the time intervals in descending order within the PROGRAM command.

After you enter a new program, the Weathernode will respond with the number of samples, and the amount of time before the storage buffer starts to overwrite old data.

Entering the PROGRAM command with no parameters will display the current program entered into the Weathernode.

Note that when programming the Weathernode, there are some very important points to keep in mind:

1. Enter the samples in descending time intervals. (i.e. PROGRAM R1H RG R10M TP TF A5M WS WD). Enter the longest time intervals first. Failure to enter the program in this sequence will result in unpredictable results.

2. All reading intervals must be an integer multiple of the next stated interval. For instance, if you enter a program: PROGRAM R1H TP RG R20S TF A15S WD WS, then the actual time intervals between samples would be:

1 hour / 20 seconds = 180 and 20 seconds / 15 seconds = 1

Therefore, the temperature would be read every 15 seconds (15 sec * 1) and the Rain Gauge and PC temperature would be read every 45 minutes (15 sec * 180)

See also: avgsampl

● **REDISPLA** n (n = $00 - $FF)
default $12 (CTRL-R)

This command is used to change the REDISPLAY-line input editing character. The parameter n is the ASCII code for the character you want to type in order to REDISPLAY the current line being entered.

See also: bkondel canline, canpac, flow

● **REMTIMER** n (n = 0 - 15) [1 minute increments]
default 1

This command sets the SYSOP inactivity timer. When you first enter the SYSOP command and the Weathernode sends the 3 lines of numbers, the timer is started. You must enter the correct password before REMTIMER expires. Once access is granted, the REMTIMER will automatically remove the sysop access, returning you to normal user access, if no activity occurs for this time interval.

See also: sysop

● **RESET**
immediate

The RESET command causes the Weathernode to erase collected sensor readings. If the ABAUD parameter has been changed, the new baud rate will take effect when this command is executed. No other parameters are affected.

See also: clear

● **RTEXT** string (1 - 128 characters)
default blank

The RTEXT command sets the password string to be used when remote access to the commands is attempted through the SYSOP command. The Weathernode will send three sets of 8 numbers in response to the SYSOP command. These numbers represent the character positions within RTEXT. The user must properly respond with the corresponding 8 characters (using any one of the three sets of numbers) from the RTEXT in order to gain access. (NOTE: This is case sensitive, and spaces are significant.)

See also: sysop

● **SCREENL** n (n = 0 - 255)
default 0

This value is used to properly format what is sent to your terminal. A <CR> sequence is sent to the terminal at the end of a line when n characters have been printed. A value of zero inhibits this action. You should set this to 0 for use in the Telemetry mode.

● **START** n (n = $00 - $FF)
default $11 (CTRL-Q)

This command specifies the character sent by the computer to the Weathernode to restart output from the Weathernode. If set to $00, only hardware flow control will be used. For software flow control, set this parameter to the character the computer will send to restart data flow.

See also: stop, xflow, xoff, xon

● **STOP** n (n = $00 - $FF)
default $13 (CTRL-S)

This command specifies the character sent by the computer to the Weathernode to stop output from the Weathernode. If set to $00, only hardware flow control will be used. For software flow control, set this parameter to the character the computer will send to stop data flow.

See also: start, xflow, xoff, xon

● **STREAM** ON|OFF
default OFF

When OFF, the Weathernode will be able to handle only one connection at a time. When ON, the Weathernode can handle multiple connects from the TNC, and responds to data from several users simultaneously by switching streams. The STREAMSW parameter must be properly set for multiple connections. The number of users is determined by the USERS command in your TNC.

See also: streamsw

● **STREAMSW** n [n] (n = $00 - $FF)
default $7C $7E

This command tells the Weathernode what streamswitch character(s) are used in your TNC. When using multi-connects, the Weathernode will echo the proper streamswitch characters for the data, and if the defined characters are contained in data, they will be preceded with the standard PASS character ($16 - CTRL-V).

● **SYSOP** (remote connection only)
immediate

The SYSOP command is used by a remote user to gain access to the commands of the Weathernode. This will allow an authorized user to change the PROGRAM, or most other parameters of the Weathernode. When the Weathernode receives the SYSOP command, it will respond with three lines of 8 numbers each. The user must then properly decode any one of the three lines into the proper password within the time set by REMTIMER to gain access. If three attempts are made to gain access without success, a penalty time of 15 minutes is imposed before it will allow another SYSOP attempt.

See also: remtimer, rtext

● **TEST**

immediate

The TEST command causes the Weathernode to perform a self test. All data and parameters will be reset to default values, and the Weathernode will require reprogramming.

● **TOLER** n (n = 0-255)

default 39 mv

The TOLER command is used in factory testing only. Changing this value will not affect operation of the Weathernode.

● **XFLOW** ON | OFF

default ON

When ON software flow control will be implemented according to the settings of START, STOP, XON, and XOFF. For normal software flow control, set XFLOW ON, START $11, STOP $13, XON $11, and XOFF $13. The Weathernode expects the computer or terminal to respond to the flow control characters XON and XOFF, and the Weathernode responds to the START and STOP characters from the computer. When OFF, the Weathernode will only use and recognize hardware flow control lines (RTS and CTS) to start or stop data. The RS-232C cable must be wired accordingly. If the software flow control characters are set to $00, software flow control is not possible.

See also: start, stop, xoff, xon

● **XOFF** n (n = $00 - $FF)

default $13 (CTRL-S)

This command selects the character sent by the Weathernode to the computer or TNC to stop data from that device. If set to $00, hardware flow control must be used. For software flow control, set this parameter to the character the computer expects to see to stop sending data.

See also: xflow, xon

● **XON** n (n = $00 - $FF)

default $11 (CTRL-Q)

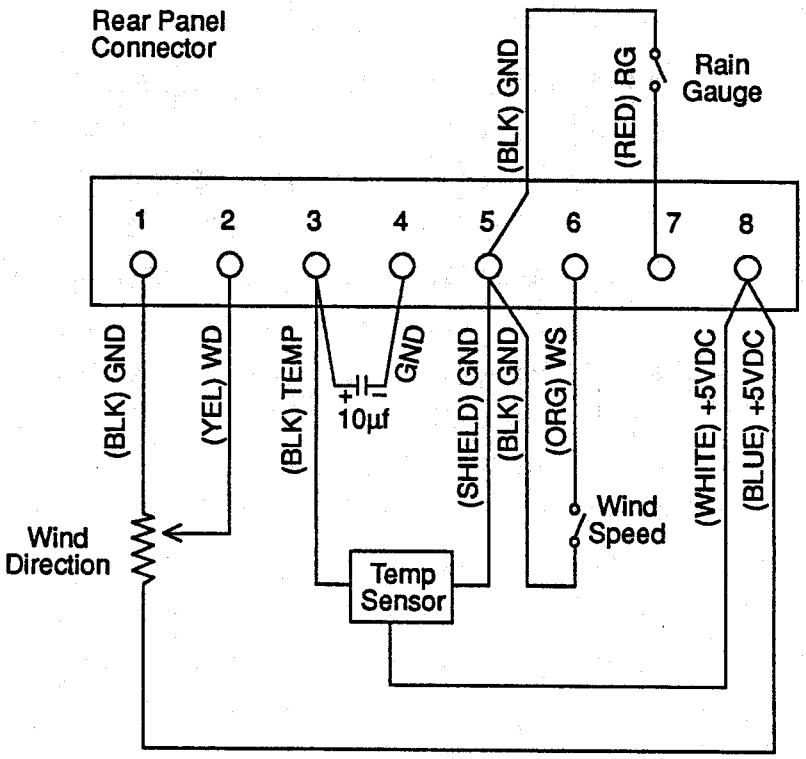
This command selects the character sent by the Weathernode to the computer or TNC to start data from that device. If set to $00, hardware flow control must be used. For software flow control, set this parameter to the character the computer expects to see to start sending data.

See also: xflow, xoff

ASCII Chart

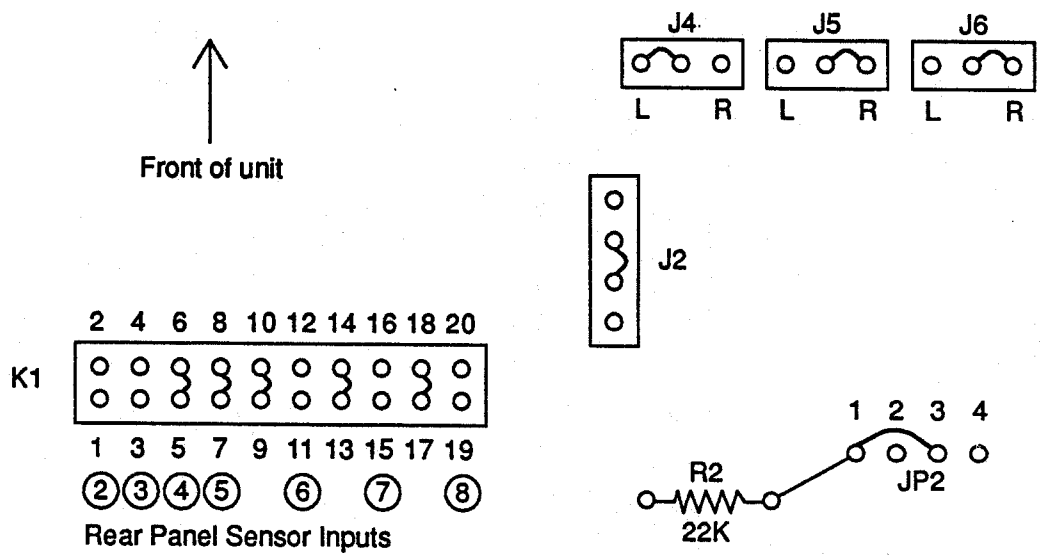
Ctrl	Dec	Hex	Code	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex
@	0	00	NUL	32	20	SP	64	40	@	96	60	`	128	80	160	A0	192	C0	224	E0
A	1	01	SOH	33	21	!	65	41	A	97	61	a	129	81	161	A1	193	C1	225	E1
B	2	02	STX	34	22	"	66	42	B	98	62	b	130	82	162	A2	194	C2	226	E2
C	3	03	ETX	35	23	#	67	43	C	99	63	c	131	83	163	A3	195	C3	227	E3
D	4	04	EOT	36	24	$	68	44	D	100	64	d	132	84	164	A4	196	C4	228	E4
E	5	05	ENQ	37	25	%	69	45	E	101	65	e	133	85	165	A5	197	C5	229	E5
F	6	06	ACK	38	26	&	70	46	F	102	66	f	134	86	166	A6	198	C6	230	E6
G	7	07	BEL	39	27	'	71	47	G	103	67	g	135	87	167	A7	199	C7	230	E7
H	8	08	BS	40	28	(	72	48	H	104	68	h	136	88	168	A8	200	C8	232	E8
I	9	09	HT	41	29	)	73	49	I	105	69	i	137	89	169	A9	201	C9	233	E9
J	10	0A	LF	42	2A	*	74	4A	J	106	6A	j	138	8A	170	AA	202	CA	234	EA
K	11	0B	VT	43	2B	+	75	4B	K	107	6B	k	139	8B	171	AB	203	CB	235	EB
L	12	0C	FF	44	2C	,	76	4C	L	108	6C	l	140	8C	172	AC	204	CC	236	EC
M	13	0D	CR	45	2D	-	77	4D	M	109	6D	m	141	8D	173	AD	205	CD	237	ED
N	14	0E	SO	46	2E	.	78	4E	N	110	6E	n	142	8E	174	AE	206	CE	238	EE
O	15	0F	SI	47	2F	/	79	4F	O	111	6F	o	143	8F	175	AF	207	CF	239	EF
P	16	10	DLE	48	30	0	80	50	P	112	70	p	144	90	176	B0	208	D0	240	F0
Q	17	11	DC1	49	31	1	81	51	Q	113	71	q	145	91	177	B1	209	D1	241	F1
R	18	12	DC2	50	32	2	82	52	R	114	72	r	146	92	178	B2	210	D2	242	F2
S	19	13	DC3	51	33	3	83	53	S	115	73	s	147	93	179	B3	211	D3	243	F3
T	20	14	DC4	52	34	4	84	54	T	116	74	t	148	94	180	B4	212	D4	244	F4
U	21	15	NAK	53	35	5	85	55	U	117	75	u	149	95	181	B5	213	D5	245	F5
V	22	16	SYN	54	36	6	86	56	V	118	76	v	150	96	182	B6	214	D6	246	F6
W	23	17	ETB	55	37	7	87	57	W	119	77	w	151	97	183	B7	215	D7	247	F7
X	24	18	CAN	56	38	8	88	58	X	120	78	x	152	98	184	B8	216	D8	248	F8
Y	25	19	EM	57	39	9	89	59	Y	121	79	y	153	99	185	B9	217	D9	249	F9
Z	26	1A	SUB	58	3A	:	90	5A	Z	123	7A	z	154	9A	186	BA	218	DA	250	FA
[	27	1B	ESC	59	3B	;	91	5B	[	124	7B	{	155	9B	187	BB	219	DB	251	FB
/	28	1C	FS	60	3C	<	92	5C	\	124	7C	|	156	9C	188	BC	220	DC	252	FC
]	29	1D	GS	61	3D	=	93	5D	]	125	7D	}	157	9D	189	BD	221	DD	253	FD
^	30	1E	RS	62	3E	>	94	5E	^	126	7E	~	158	9E	190	BE	222	DE	254	FE
_	31	1F	US	63	3F	?	95	5F	_	127	7F	DEL	159	9F	191	BF	223	DF	255	FF

KTU Weathernode Sensor Wiring



KTU Weathernode Jumper Locations

Factory Default



KTU Specifications

(with Weathernode EPROM)

Size: 1-3/4" x 6" x 8"

Weight: 2-1/4 lbs.

Power Requirements:	**With LEDs**	**Without LEDs**
Isupply:	45 ma max / 40 ma typ	30 ma max / 25 ma typ
Vsupply:	11v - 20v	11v - 28v

Computer Port:

TTL: 0v - 5v

RS232: –8v - +8v

Analog Data Inputs:

Voltage Range: 0v to +5v

Resolution: 10 bit (5 mv)

Frequency Response: ≤ 5 Hz

Max Input Voltage: ≤ ±50 VDC continuous

Temperature Sensor (External)

Temp Range: –40°F to 230°F (–50°F to 300°F available)

Accuracy:

Better than ±2°F typ / ±3°F max @ 70°F

Better than ±3°F typ / ±5°F max @ –40°F to 230°F

KTU Battery Life:

Although it will vary from unit to unit, useful battery life for a KTU is calculated to be on the order of at least 2-1/2 to 3 years. This would be the effective shelf life of an unused unit. The more a unit is operational, the less current is drawn from the battery thus increasing its lifetime.

A measured battery voltage of 3.0v to 3.3v is nominal, with a 2.2v reading indicating a weakening (but still operational) battery. The battery should be replaced when its voltage falls below 2.0v. Only a Duracell DL2430 or equivalent lithium battery should be used for replacement.

WARNING: Lithium battries should not be incinerated.

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Appendix A
General Information

The KTU can provide for 0-5 volt analog inputs, digital inputs, digital outputs, and a regulated +5 volt supply voltage for limited powering of external sensors. Desired combinations of these inputs and outputs are selected with removable PC board jumpers, so the 10 pin rear panel connector can be configured in a variety of ways.

Analog signals are input through low-pass filters (effective bandwidth about 5 Hz) to an 11 input, 10 bit analog to digital (A/D) converter. One input is committed to the local on-board temperature sensor (0 - 200 degrees Fahrenheit) with the remaining 10 converter inputs available for external signals. These converter inputs are reasonably well protected and will handle small static charges and continuous over-voltages to about +/– 50 Volts DC. Additional protection should be considered if larger transient voltages are expected on any signal input.

All sensor signals to and from the KTU are connected to the 10 position rear panel terminal strip. The first two pins (marked POWER) are for the KTU supply voltage with the remaining eight positions (marked SENSORS) used as follows.

Pin 1 is fixed as signal ground. The seven other pins are independently defined with small board jumpers on headers K1, J4, J5, and J6. (See appendix B for details).

If pin 8 is used to supply power for external sensors, it is suggested that the current requirements be limited to 10 ma or less. If more current is required for the external sensors, or if they could introduce excessive noise or dangerous voltage transients, we suggest using the supply source for the KTU.

Three of the KTU inputs (Pins 2, 3, and 4) provide for additional signal handling capability over that of the other analog inputs which are constrained to 0-5 volt signals only. These inputs can address applications requiring measurements of current or resistance and can also accommodate negative input signals. Each of these three inputs allows for installation of PC board resistors, connected from the signal input line to the +5 volt reference, the negative circuit supply (–5 volts if TTL, or –8 volts if RS-232), or to signal ground. For example, a 250 ohm precision resistor connected from a signal input line to ground would convert a 4-20 ma input signal current to a 1-5 volt signal voltage.

Similarly, an external resistance could be measured by connecting a known on-board resistor from the +5 volt reference to the input, with the unknown resistance connected from the input to ground. The voltage formed by this divider can then be used to calculate the unknown resistance value.

CAUTION: The current draw from the +5 volt reference should be limited to several milliamps.

Connecting a PC board resistor from a signal input to the negative supply voltage is necessary in some applications such as using the KTU external temperature sensor, where a negative voltage is required to measure minus temperatures. This, however, requires shifting negative signal levels into the 0-5 volt input range required by the A/D converter. This level shifting is realized using an operational amplifier circuit that is normally configured for unity gain and a +1 volt output offset from its input. This allows for input voltages of –1 to +4 volts.

Digital inputs are pulled high to +5 volts through 10K resistors and digital outputs are driven by standard digital CMOS logic outputs. These inputs, like the analog inputs, should have additional transient suppression if continuous voltages greater than ±50 VDC are possible.

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Appendix B
Sensor Configuration Information

The KTU will support up to seven (7) sensors attached to the rear panel inputs, plus one on-board temperature sensor. Each of the 7 external inputs accepts a 0-5 VDC input, allowing any sensor to be connected, as long as it can be scaled to this range.

Valid sensor identifiers for use in the DATA and PROGRAM commands are:

V0, V1, V2, V3, V4, V5, V6, V7, V8, V9, V10
C0A, C0C, C0F, C0I, C0P, C0W
C1A, C1C, C1F, C1I, C1P, C1W
G

The Weathernode also recognizes pre-defined sensors called TF, TPCB, WS, WD and RG.

Pin 1 on the rear panel is ground, and will serve as the reference for the sensor inputs. Any of the seven inputs may also be connected to ground by placing a jumper on K1, allowing you to have more than one ground for your inputs. We recommend that any unused inputs should be connected to ground. The following chart shows jumper positions required to ground a given input pin.

Input pin	**Place jumper on K1 between pins**
1	Always ground
2	1 & 2
3	3 & 4
4	5 & 6
5	7 & 8
6	11 & 12
7	15 & 16
8	19 & 20

Most of these inputs can be configured for different purposes, requiring internal jumpers to be configured for the required input.

Pin 2 on the rear panel can be read as a 0-5 volt DC voltage (**V0**). This input is normally used (with the Weathernode EPROM) for wind direction (**WD**). In this configuration, there should be no jumper installed on K1 pins 1 and 2. Pin 2 could also be configured to allow an input voltage between –1 and +4 volts DC (**V7**). To obtain this input, there should be no jumper on K1 pins 1 and 2, and you must install a jumper on the center 2 pins of J1. In this situation, the input signal is simultaneously read at V0 and at V7 (with a +1 volt offset).

Pin 3 on the rear panel can be read as a 0-5 volt DC voltage (**V1**). To obtain this type of input, there should be no jumper on K1, pins 3 and 4. Pin 3 can also be configured to allow input voltages between –1 and +4 volts (**V8**). This is accomplished by having no jumper on K1 pins 3 and 4, and installing a jumper on the center 2 pins of J2. This is the normal configuration shipped with the Weathernode EPROM, and is used for the external temperature sensor (**TF**). NOTE: It is necessary to have a 10µf cap from this pin to ground to insure temperature sensor stability.

Pin 4 is not used as shipped from the factory, and is grounded with a jumper on K1 pins 5 and 6. If desired, this pin can be configured to accept an input of 0-5 volts DC (**V2**) by removing the jumper on K1 pins 5 and 6. You may also configure this to accept an input of –1 to +4 volts by placing a jumper on the center 2 pins of J3 (**V9**). This pin would be the best choice for connecting and reading a second temperature sensor.

Pin 5 on the rear panel can only be configured to accept a 0-5 volt DC input (**V3**), by removing the factory installed jumper on K1 pins 7 and 8. If desired, pin 5 may be simultaneously connected to another channel (**V4**) by placing a jumper on K1 pins 7 and 9. In this case V3 and V4 would both read the same value.

Pin 6 offers several variations for input and output. Placing a jumper on K1 pins 9 and 11 will configure pin 6 for 0-5 volts DC (**V4**). Alternately, you could place a jumper between pins 11 and 13, reading the 0-5 volt input as (**V5**). If you do not place any jumper on K1 pin 11, you can then use pin 6 on the rear panel as a digital input, or as a counter input.

To use this pin as a counter input (C0x), place a jumper on J4 between the center post and left post as you look at the rear of the unit. The acceptable input frequency for the counter stage is < 4000 Hz. Available information in this configuration would be: Average frequency (**C0A**), Totalizing count (**C0C**), Instantaneous frequency (**C0F**), Interval count (**C0I**), Period in microseconds (**C0P**), and Pulse width (**C0W**). This configuration can also be used to read a digital input (**G**).

The totalizing count will reset to 0 after 2^32 (approximately 4 billion). If using the interval count, the counter is reset to 0 every sample time interval as defined in the PROGRAM command. Time period measurements are restricted to the range of 250 microseconds to 1.1 hours.

As shipped from the factory, this input is used by the Weathernode EPROM as the Windspeed (**WS**).

Pin 7 on the rear panel also offers several options for programming. Placing a jumper between pins 13 and 15 on K1 will configure this input for 0-5 volts DC (**V5**). You may instead obtain a 0-5 volt reading (**V6**) by placing the jumper between pins 15 and 17 on K1.

With no jumper installed on K1 pin 15, you can configure pin 7 on the rear panel to be a digital input or output, or a counter input. Installing a jumper on the center and left posts of J5 (looking at the rear of the unit) will configure this pin as a digital output or frequency output. You can set the digital output to a high (5v) with the command F1 1. If you wish to set this output to a low (0v) use the command F1 0. This output can also be used to generate a square wave of frequency f (10 - 4000 Hz) with duty cycle d (1 - 99 %) by issuing the command F1FREQ f d.

Configuring pin 7 as a counter input (C1x) or digital input (**G**) is accomplished by placing a jumper on the center and right posts of J5. This is the factory default configuration and is used for the Rain Gauge (**RG**). If you are using this as a counter input, and the input frequency is above 50 Hz, then either C0, F1FREQ, or F2FREQ must be at least twice the highest frequency applied to pin 7, unless a jumper is installed on J7. If this jumper is installed, however, you may not use F1. The counter information available is: Average frequency (**C1A**), Totalizing count (**C1C**), Instantaneous frequency (**C1F**), Interval count (**C1I**), Period in microseconds (**C1P**), and Pulse width (**C1W**). If you wish to measure pulse width (**C1W**), you must place a jumper on J7, and F1 is not available for use.

Pin 8 on the rear panel can also be programmed for several functions. As shipped from the factory, there is no jumper on K1 pin 19 and a jumper on the center and right posts of J6 (looking at the rear of the KTU). This configures pin 8 as a source of +5 volts which is used to feed the attached temperature and wind direction sensors. If the J6 jumper is placed on the center and left posts, pin 8 becomes a digital output (F2) or frequency output (F2FREQ).Issuing the command F2 1 will set pin 8 to +5 volts, and the command F2 0 will set it to 0 volts. If you want pin 8 to generate a square wave, use the command F2FREQ f (1-4000). This will generate a frequency of f Hz, with a 50% duty cycle.

The last possibility for pin 8 is to remove the jumper from J6 and install a jumper on K1 pins 17 and 19. This will configure pin 8 as a 0-5 volt DC input (**V6**).

The final sensor available is V10, which is permanently attached to the internal temperature sensor (**TPCB**).

KTU Weathernode Sensor Input Options

Terminal No.	1	2	3	4	5	6	7	8
Option A	GND	GND	GND	**GND**	**GND**	GND	GND	GND
Option B	GND	V0 / V7	V1 / **V8**	V2 / V9	V3	V4	V5	V6
Option C	GND					V5	V6	
Option J L	GND					**J4** C0/DI	**J5** F1/DO	**J6** F2/DO
Option J R						DO	C1/DI	+5v
Weathernode Signals	GND	Wind Direction **WD**	Temp **TF**	GND	GND	Wind Speed **WS**	Rain Gauge **RG**	+5v

Any terminal pin may be programmed to be defined with any of the signals listed in its associated column

Bold indicates factory default

Notes:

1. Under Option B, Terminals No. 2, 3, and 4 are input directly to V0, V1 and V2 and simultaneously input to V7, V8, and V9 through separate signal conditioning circuits.

2. Main Options A, B, C, and J are selected with jumpers on the K1 Header.

3. Sub-Options L and R (of main option J) are selected on Headers J4, J5, and J6.

5. V0, V1, and V2 inputs can also be tied through a resistor to Vref, V–, or Ground

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Appendix C
Anemometer (optional)

Introduction

The anemometer is designed to give very high accuracies. A two wire cable is used to give wind speed and a three wire cable is used for wind direction. Precision components, like stainless steel ball bearings and shafts, are used throughout to insure years of reliable service.

As with any precision instrument, care must be used during installation. Please read these instructions carefully.

Parts

The anemometer comes with five main parts: 1) Main arm assembly with wire, 2) Wind direction tail fin assembly, 3) Wind speed cups assembly, 4) Mounting base, and 5) Mounting hardware package.

Hardware:

2	U-bolts
4	1/4 x 1-1/2 lag screws
4	1/4 washers
4	1/4 - 20 hex nuts
1	Allen wrench
1	4-40 x 1 self-clenching screw
1	4-40 hex nut
1	3-wire pigtail (black, yellow, blue) on the 3.5 mm stereo jack the yellow wire is tip, blue wire is ring, black wire is sleeve
1	2-wire pigtail (black, orange) on the 3.5 mm stereo jack the tip is not used, the orange wire is ring, black wire is sleeve
1	this instruction sheet

Tools

You will also need a 7/16 wrench and a pair of pliers for the installation.

Mounting

A special high strength universal mounting base is provided to facilitate a rugged and reliable installation. The mounting base is designed to be attached to either a flat surface or a pipe. Although most installations are mounted directly onto standard antenna masts a variety of other installations can be employed using the universal mounting base. If you wish to mount the base on a mast too large for the standard U-bolts to accept, it is suggested you use two standard stainless steel hose clamps which can be purchased in any size. The hose clamps can be fitted around the base and mast, covering the U-bolts' mounting hold.

Four lag screws are provided for installations into wood surfaces, such as wood poles and the peaks of buildings. An important point should be noted. For high accuracy, the

anemometer should always be mounted above roof lines. If you wish to mount the anemometer on the peak of your house, be sure to use a section of pipe or wood to raise it more than four feet above the roof line. Also, to insure the greatest accuracy, use a level to make sure the base is mounted vertically.

Assembly

The anemometer comes held down in its box with four reusable cable ties that you may use to secure the double wire cables that connect to the KTU. Very little assembly is required. An allen wrench (provided) and a pair of pliers are all the tools you will need. Mount the anemometer arm into the base, with the arm increasing with height as it extends outward. Secure it using the 4-40 x 1 self-clenching screw and hex nut. Next secure the wire to the mast using cable ties. Optional 40 foot extension cables are available (EC-40) for installations requiring longer lead-in wire. If the EC-40 cables are used (you will need two), be very careful to keep the connectors dry. This can be accomplished by keeping them under eves or by sealing them with silicon rubber cement (RTV).

WIND CUPS: Now you are ready to slide the wind cups onto the shaft in the bottom of the anemometer head, making sure the cups angle downward. Also make sure the caps are pushed all the way into the housing to insure the magnet in the cup assembly comes very close to the reed switch located in the main housing. The magnet and reed switch should be far enough apart so that they do not actually touch, and the wind cups should spin freely. Every time the cups make one revolution, the reed switch will actuate and send a signal to the KTU. Use the allen wrench to tighten the cup assembly. (Caution: Overtightening may strip the threads.)

TAIL FIN: The tail fin is the final part to be assembled. Locate the connector, identified with blue tape, and plug it into the three-wire pigtail. (See Connecting Sensors to your KTU in the main part of the KTU manual for wiring details.) Program the KTU to read wind direction every second, with the command: PROGRAM R1S WD. Next, slowly turn the wind direction shaft until you feel a slight detent, which should indicate a 0 degree reading at the KTU. (You will need to issue the DATA command to obtain a reading. Adjust the shaft as needed.) Next, install the tail fin onto the shaft so the nose points due north. Finally, use the allen wrench to tighten the set screw, just as you did with the wind cup assembly.

TESTING: Point the nose of the wind direction indicator due north, issue the DATA command on the KTU, it should read 0 degrees. When the nose is turned due south, the KTU should read 180 degrees. Next put the other lead into the two-wire pigtail. You can now spin the cup assembly and get wind speed readings from the KTU (use the PROGRAM command to tell the KTU the method of recording, then give the DATA command to see the readings). This verifies that the anemometer and KTU are fully operational, and completes the anemometer installation.

Warranty and Repair Information

CAUTION: Climbing on your roof can be hazardous. If you are uneasy about installing your unit, please have a qualified professional complete the installation. Kantronics specifically disclaims any liability for any injury or loss resulting from the installation or use of the Anemometer.

WARRANTY: Kantronics warrants this Anemometer to be free from defects in material and workmanship for 90 days from date of purchase. Kantronics will repair or replace (at its option) any Anemometer which, upon inspection by the factory, is found to be defective under the terms of this warranty. This warranty extends only to the original purchaser. Kantronics shall have no liability in the event of misuse, abuse, or other causes beyond its reasonable control.

Appendix D
Rain Gauge (optional)

Please Note – Remove float retention wire before installing

Introduction

Please take the time to read this instruction manual carefully.

We have organized the manual so that it takes you step-by-step through each of the activities required to set up and install your Rain Gauge, in the order in which you will need to do them. By following these steps – and setting the system up correctly from the start – you will soon be able to enjoy all of the features of your Rain Gauge, with a minimum of time and effort.

Testing the Rain Gauge

Before installing the Rain Gauge, test the unit in your kitchen or yard to be sure it is functioning properly. To test the Rain Gauge:

1. Separate the cone from the base by prying the Rain Gauge apart with your hands. The fit may be quite snug; be persistent and it will come off.

2. Connect the Rain Gauge to your KTU by plugging its mini plug into the 2 wire pigtail with the Black and Red wires. The black wire from the pigtail connects to the KTU sensor block pin 5, and the red wire connects to pin 7.

3. Program the KTU with the command: PR R10S RG. This sets the Weathernode to read the Rain Gauge every 10 seconds.

4. Slowly pour a small amount of water into the collection tube (the large tube in the middle of the Rain Gauge). Stop pouring when the water begins to flow through the clear plastic siphon tube. This is equivalent of 0.1 inch of rain. The collection tube should empty completely and issuing the DATA command on the KTU should give the reading. Note that since the program only reads the sensor every 10 seconds, you may have to repeat the data command a few times to see the reading. If it does not, see the Troubleshooting Guide.

5. To clear your test results use the RESET command.

Installing the Rain Gauge

To install the Rain Gauge, you will need a screwdriver to mount the base. You will also need electrical tape and insulated cable staples or straps to secure the cable and keep it from whipping about in the wind.

After testing the Rain Gauge including all extension cables, install the unit as follows:

1. Choose a flat, level surface out in the open. In choosing your spot, please note the following:

a. The Rain Gauge contains a magnet-operated switch and it may not operate correctly if it is mounted on or near a magnetic surface. To install the Rain Gauge on a sheet metal roof, insulate the unit from the metal by making a platform out of 2 x 4s. The base of the Rain Gauge should be at least 1-1/2 inches away from the metal surface.

b. Pick a location that is easily accessible for normal cleaning. For best results and minimal maintenance, install the Rain Gauge away from trees or other potential sources of heavy pollen or debris.

c. The Rain Gauge is self-emptying. Water drains off through holes in the base. Be sure that there is an unobstructed path for runoff.

2. If you have not already done so, separate the cone from the base.

3. Fasten the base to the mounting surface using the three #6 screws provided. Do not over-tighten.

4. If you are using an extension cable, connect the extension cable to the Rain Gauge cable. To prevent possible problems from exposure to the weather, run a bead of silicone rubber sealant all the way around the area where the two cables come together. Be sure to seal the connection completely.

5. To prevent fraying or cutting of the cables, secure the cables with electrical tape or insulated cable staples or straps so that they do not whip about in the wind.

6. As you secure the cables, try to place the connection between the Rain Gauge cable and the extension cable under the eaves of your house protected from rain and weather.

7. To be certain that the Rain Gauge is functioning properly after installation, retest the unit as described earlier.

Maintaining the Rain Gauge

Maintaining the Rain Gauge is simple. Once or twice a year, unplug the Rain Gauge from the KTU. Remove the cone from the base, and then remove the clear plastic siphon tube from the collection tube. Use warm, soapy water and a soft cloth to clean pollen, dirt, and other debris from the cone, and use a cotton swab to clean out the siphon tube and other internal components. Rinse thoroughly with plain water before reassembling.

In areas of severe winters, you may wish to bring the Rain Gauge inside during the winter. Although freezing temperatures should not cause the Rain Gauge to crack, the plastic may become more brittle. If this happens, the Rain Gauge will be more susceptible to damage from external sources. If you choose to leave the Rain Gauge outside, cover it with a piece of plastic to prevent water from collecting and freezing inside the unit.

Troubleshooting Guide

While the Rain Gauge was designed to provide years of trouble-free operation, occasional problems may arise. If you are having a problem with your Rain Gauge, please review the following list before sending the unit in for repair. If, after reviewing the guide, you are unable to resolve the problem, please call the factory at (913) 842-4476 for further instructions. Please do not return your unit without prior authorization.

DATA command does not read 0.1 when you test the Rain Gauge:

1. Make sure the Rain Gauge is on a level, non-magnetic surface.

2. Check foam float and siphon tube. The foam float should be free to move up and down. If the bottom edge of the siphon tube is below the reed switch, the float will not be able to rise high enough in the float chamber. Repeat the test procedure, watching to see that the float rises up and touches the bottom of the reed switch. Readjust the siphon tube if necessary.

3. Check reed switch installation. A wire should be soldered to each end of the reed switch, and the switch should be installed over the float chamber so that the glass envelope is off center.

4. Check cables.

5. Test the Rain Gauge in another way by turning it upside down. If the foam float does not fall right away, tap the base gently with your hand. The DATA command should read 0.1" increase. If it does not, the Rain Gauge is probably defective and should be returned to the factory.

Rainfall does not register on the KTU after installation:

1. Check installation. Rain Gauge must be mounted on a flat, non-magnetic surface with unobstructed path for runoff. See installation instructions.

2. Clean internal components of Rain Gauge with cotton swab and soapy water. Make sure siphon tube is positioned correctly. If too low in float chamber, reed switch will not register. See maintaining instructions.

3. Check the PROGRAM set in the Weathernode to insure that the Rain Gauge is being sampled periodically.

Warranty and Repair Information

CAUTION: Climbing on your roof can be hazardous. If you are uneasy about installing your unit, please have a qualified professional complete the installation. Kantronics specifically disclaims any liability for any injury or loss resulting from the installation or use of the Rain Gauge.

WARRANTY: Kantronics warrants this Rain Gauge to be free from defects in material and workmanship for 90 days from date of purchase. Kantronics will repair or replace (at its option) any Rain Gauge which, upon inspection by the factory, is found to be defective under the terms of this warranty. This warranty extends only to the original purchaser. Kantronics shall have no liability in the event of misuse, abuse, or other causes beyond its reasonable control.

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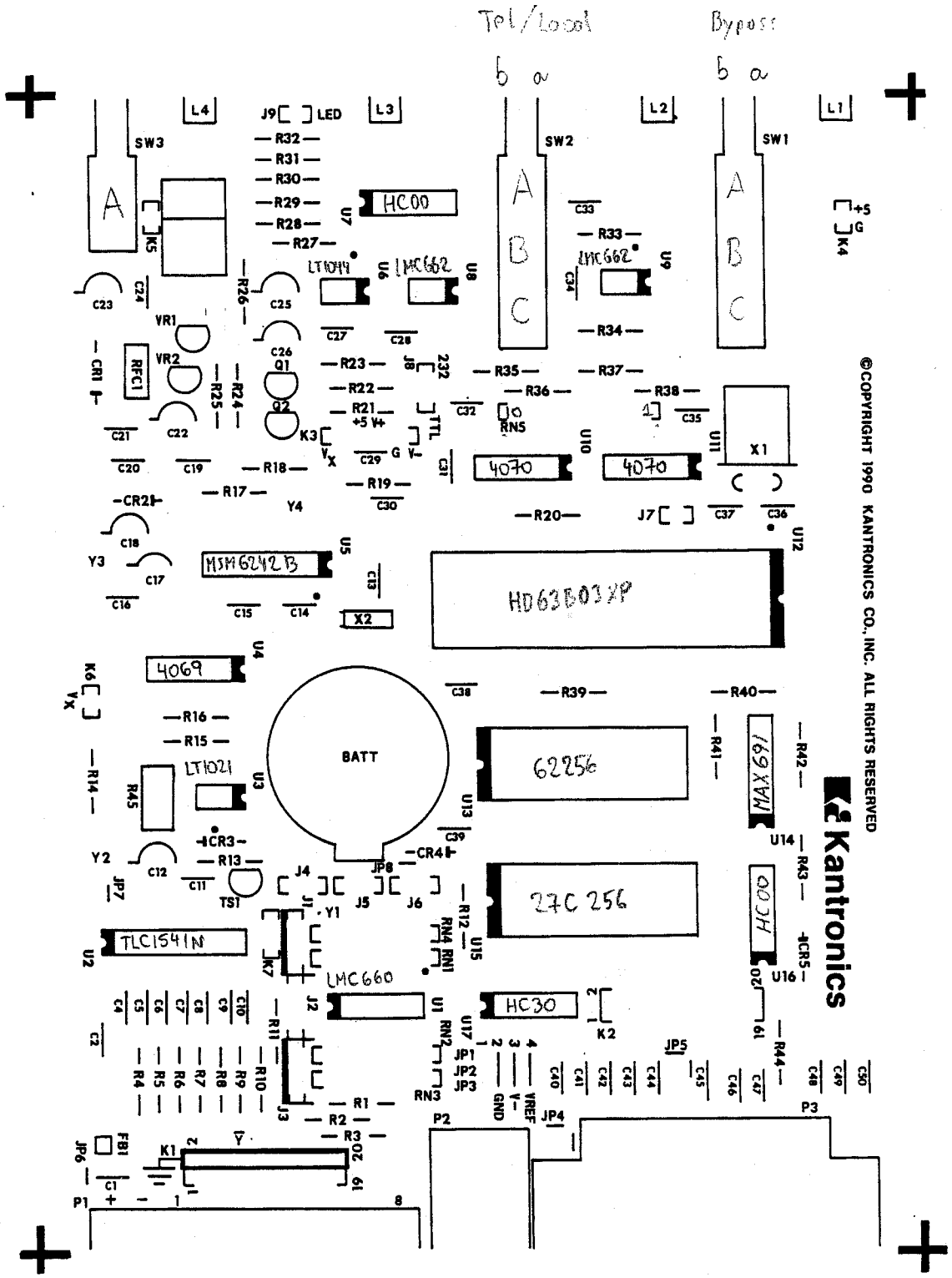
KTU Parts List

R2	22K	C9	.1	U4	4069
R4	10K	C10	.1	U5	MSM6242
R5	10K	C11	.1	U6	LTC1044
R6	10K	C12	1µf Al	U7	74HC00
R7	10K	C13	.1	U8	LMC662
R8	10K	C14	20pf	U9	LMC662
R9	10K	C15	20pf	U10	4030
R10	10K	C16	.1	U11	4030
R12	10K	C18	1µf Al	U12	63B03X
R13	27K	C19	.1	U13	62256
R15	100K	C20	.1	U14	MAX691
R16	10K	C21	.1	U15	27C256
R17	100K	C22	10µf Al	U16	74HC00
R18	10K	C23	10µf Al	U17	74HC30
R19	100K	C24	.1	X1	2.4576 MHz
R20	100K	C25	10µf Al	X2	32.768 KHz
R21	100K	C26	10µf Al	RFC1	10µh
R22	82K	C27	20pf		
R23	100K	C28	.1		
R24	2.2K	C29	.1		
R25	330	C30	.001		
R26	1.8K	C31	.1		
R27	220K	C32	.1		
R28	10K	C33	.001		
R29	10K	C34	.001		
R30	330	C35	.1		
R31	330	C36	20pf		
R32	330	C37	20pf		
R33	270	C38	.1		
R34	270	C39	.1		
R35	6.8K	C40	.001		
R36	6.8K	C41	.001		
R37	270	C42	.001		
R38	6.8K	C43	.001		
R39	10K	C44	.001		
R40	51K	C45	.1		
R41	1M	C46	.001		
R42	10K	C47	.001		
R44	10K	C48	.001		
F45	50K Pot	C49	.001		
RN1	10K	C50	.001		
RN2	10K	CR1	1N4001		
RN3	10K	CR2	1N914		
RN4	10K	CR3	1N914		
RN5	100K	TS1	LM34DZ		
C1	.1	Q1	2N7000		
C2	.1	Q2	PN2222		
C4	.1	VR1	LP2950		
C5	.1	VR2	LM317L		
C6	.1	U1	LMC660		
C7	.1	U2	TLC1541		
C8	.1	U3	LT1021		



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