Stuttgart M32 Intelligent Controller/Logger User Manual

Table of Contents

Introduction

This guide will guide you through the configuration and setup of the product.

There are different options and versions of the product. Please identify the features that you have purchased in the list below.

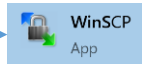
- 1,2 CAN2.0B Smartmicro Radar inputs
- Internal Voltage & Temperature sensing
- Long Range Buetooth 5 radio
- 4, 8 or 16 Solid State Relays
- 100 baseT Ethernet
- 8 Opto Isolated Inputs
- 8 ADC inputs with PGA at 16 bits
- 1, 2 RS232 port
- 1, 2 RS485 port
- Micro-SD card
- USB port

Architecture

CAN 2.0

Central Server (NTCP/FTP)

NTCIP FTP



NTCIP SNMP

HTTP

Zone	Class	AvgSpeed	Volume	Occupancy
1	UNDEFINED	0	0	0
1	PEDESTRIAN	0	0	0
1	BIKE	0	0	0
1	MOTOR BIKE	0	0	0
1	CAR	77	14	15
1	LONG TRUCK	69	5	8
1	VAN	67	1	3
1	SHORT TRUCK	62	0	1
2	UNDEFINED	0	0	0
2	PEDESTRIAN	0	0	0
2	BIKE	0	0	0
2	MOTOR BIKE	0	0	0
2	CAR	83	18	19
2	LONG TRUCK	0	1	0
2	VAN	73	3	4
2	SHORT TRUCK	71	2	4
3	UNDEFINED	0	0	0
3	PEDESTRIAN	0	0	0
3	BIKE	0	0	0
3	MOTOR BIKE	0	0	0
3	CAR	90	16	15
3	LONG TRUCK	0	0	0
3	VAN	80	2	2
3	SHORT TRUCK	0	0	0
4	UNDEFINED	0	0	0
4	PEDESTRIAN	0	0	0
4	BIKE	0	0	0
4	MOTOR BIKE	0	0	0
4	CAR	100	10	9
4	LONG TRUCK	0	0	0
4	VAN	97	2	1
4	SHORT TRUCK	0	0	0

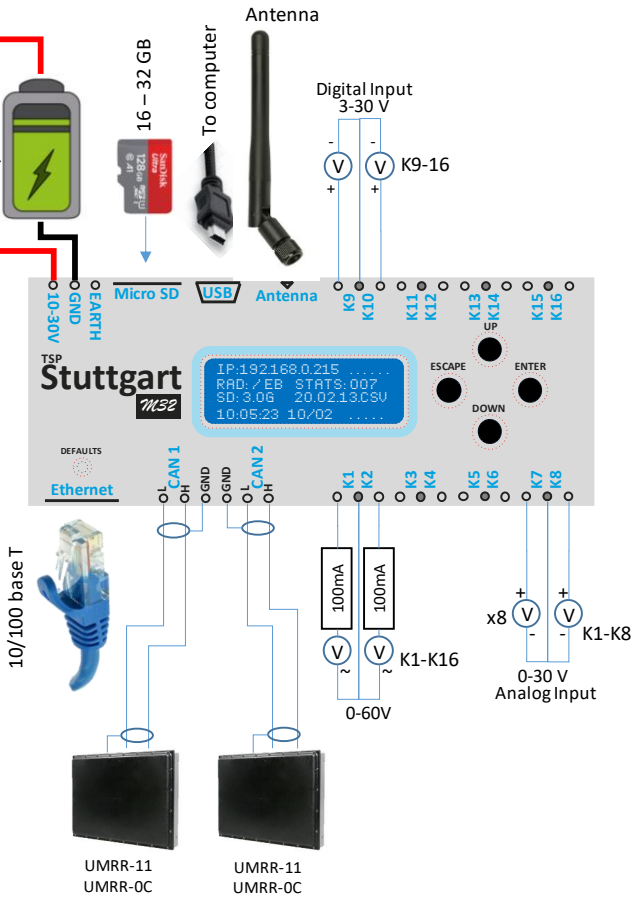
LCD

uSD

Central Server (Mango/NTCIP)

Connecting up the Stuttgart M32

The controller must be connected as shown below, depending on the options selected.



Take care in connecting the earth connector to chassis or earth ground. Internal Surge protection is provided from both the positive and negative terminal to this point and any surges will dissipate to that point.

The connectors are manufactured by Phoenix Contact and other manufacturers and have 3.81mm pin spacing. The part numbers for the Phoenix Contact parts are shown below:

Connector	Pins	Part number	Photo
Power	3	MC 1,5/ 3-ST-3,81	
Inputs/Outputs	12	MC 1,5/ 12-ST-3,81	
Communications	6	MC 1,5/ 6-ST-3,81	

Operation

Functionality

The Stuttgart M32 has discrete firmware which is more reliable and more responsive than operating system based firmware. It organises its functions in priorities with some functions being able to interrupt other functions. The highest level priority is managing the streaming interfaces from the radar. The radar stream data without interruption and the controller therefore need to be able to catch all the data without loss. The LCD, Ethernet and filesystems are buffered and at a lower priority.

The Stuttgart M32 read radar data, store it, translate it and transmit it in various formats. In summary the M32 enhances the Smartmicro (SMS) sensors by:

- ✓ Recording statistics and per vehicle traffic data up to 24 months
- ✓ Expand the outputs to 16 relay outputs
- ✓ View traffic, status and diagnostics on LCD next to the road
- ✓ Protocol translation to WTX, RTMS and NTCIP
- ✓ NTP time source synchronised with battery backup
- ✓ Analog/Digital Input/Output terminal interface

In addition the Stuttgart M32 is able to do both Bluetooth 5 travel time measurement and interface to Stuttgart magnetometers.

Startup procedure

The Stutgart M32 when powered up, will first enter the bootloader used for reprogramming the device. If there is a valid application installed it will execute the main application, otherwise it will wait in bootloader for a

program to be installed. The M32 can be put in bootloader mode through the web interface remotely. If the M32 is put in bootloader mode, it will remain there for 3 minutes and if no new program is installed it will automatically advance to run the installed program.

The application program will first show the firmware version on the LCD and then initialize the micro-SD card, if it detects the insertion switch of the micro-SD socket.

Once it displays the main page, the device is completely started up and all functions should be operable

Restoring defaults

You can reset the factory defaults by using a sharp object to push the DEFAULTS button just behind the Ethernet connector. The button has to be held in on power-up. “HOLD BUTTON TO RESTORE DEFAULTS” will be displayed. Continue to hold the button until “RELEASE BUTTON NOW, DEFAULTS RESTORED!” is displayed.

IP address:	192.168.0.215
Subnet mask:	255.255.255.0
Default gateway:	192.168.0.1
Primary DNS:	8.8.8.8
Secondary DNS:	4.4.4.4
NTP Server:	162.159.200.123
Hostname:	STUTTGART
Logging enabled:	Stats only

Interfaces

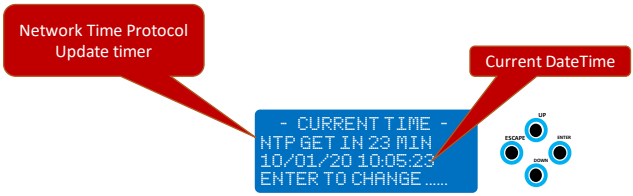
Ethernet

The Ethernet is a 10/100 base T interface. The green LED is the LINK indicator and the yellow LED is the DATA indicator. The interface supports both UDP/IP and TCP/IP. The MAC address is programmed at the factory. It is possible through data corruption that the last 3 bytes of the MAC address reset to zero. If this happens please contact the factory with the serial number of the unit to be able to reconfigure the MAC address to the correct factory value. Ethernet supports the following protocols:

- ICMP server (responding to ping)
- HTTP server over TCP/IP (web interface)
- SNMPv1 server over UDP (NTCIP)
- FTP server over TCP/IP (access to micro SD card)
- HTTP client (GET posting of Bluetooth travel time values)
- DHCP client (disabled by default)
- SNTP client (network time protocol)

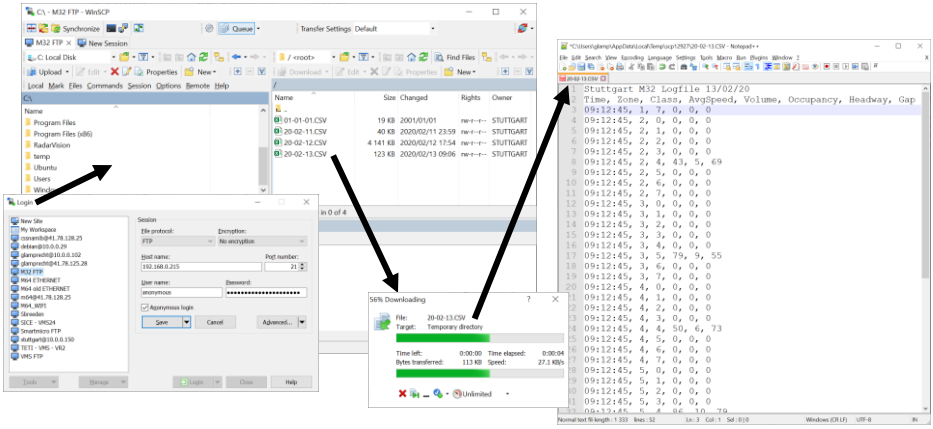
Network Time Protocol (SNTP port 123)

The default server address is 162.159.200.123 attempting to update the realtime clock every 30 minutes. If the NTP server is reachable, the letters “NTP” will appear after the time on the web interface. The LCD page 2 will either show “NTP UPDATE IN -- MINUTES” or “NTP UNAVAILABLE”. NTP servers always report time with reference to GMT. Therefore you can configure the time offset on the web interface from GMT -12 to GMT +12. Should you require daylight savings you have to program that into your own NTP server.



FTP Server (port 21)

The Stuttgart M32 has a built-in FTP server and will allow remote access to all the files on the micro-SD card. The FTP protocol has had numerous incompatible revisions and different implementations. It is therefore advisable to use specific FTP clients shown to have worked with the server implementation. One such client is WinSCP. When using WinSCP you must select FTP as the protocol as shown below:



ICMP server

You can see if the Stuttgart M32 ethernet is active by using the ping command (ICMP message). Note that when the device is in bootloader mode it does not support ICMP.

SNMP – NTCIP 1209 (port 161)

The M32 controller supports SNMP v1 and NTCIP 1209 objects shown below.

Parameter name	OID	Type
SYS_UP_TIME	1.3.6.1.2.1.1.3	READONLYTIME_TICKS
streamsAlarmError	1.3.6.1.2.1.33.1.6.3.18	READONLYBYTE
ConfigFlags	1.3.6.1.4.1.17095.1.16	READWRITEBYTE
sensorSystemReset	1.3.6.1.4.1.1206.4.2.4.1.1	READWRITEWORD
sensorSystemStatus	1.3.6.1.4.1.1206.4.2.4.1.2	READONLYBYTE
maxSensorZones	1.3.6.1.4.1.1206.4.2.4.1.4	READONLYBYTE
sensorZoneNumber	1.3.6.1.4.1.1206.4.2.4.1.5.1.1.ZONE	READONLYBYTE
sensorZoneOptions	1.3.6.1.4.1.1206.4.2.4.1.5.1.2.ZONE	READONLYBYTE
sensorZoneOptionsStatus	1.3.6.1.4.1.1206.4.2.4.1.5.1.3.ZONE	READONLYBYTE
sensorZoneSamplePeriod	1.3.6.1.4.1.1206.4.2.4.1.5.1.4.ZONE	READONLYBYTE
sensorZoneLabel	1.3.6.1.4.1.1206.4.2.4.1.5.1.5.ZONE	READWRITEASCII_STRING.
sampleEndTime	1.3.6.1.4.1.1206.4.2.4.3.4.1.3.CLASS.ZONE	READONLYDWORD
volumeData	1.3.6.1.4.1.1206.4.2.4.3.4.1.4.CLASS.ZONE	READONLYWORD
percentOccupancy	1.3.6.1.4.1.1206.4.2.4.3.4.1.5.CLASS.ZONE	READONLYWORD
speedData	1.3.6.1.4.1.1206.4.2.4.3.4.1.6.CLASS.ZONE	READONLYWORD
zoneStatus	1.3.6.1.4.1.1206.4.2.4.3.4.1.7.CLASS.ZONE	READONLYBYTE
SequenceNumber	1.3.6.1.4.1.1206.4.2.4.3.4.1.8.CLASS.ZONE	READONLYBYTE
zoneClassTable	1.3.6.1.4.1.1206.4.2.4.3.5.1.0	READONLYBYTE
moduleVersion	1.3.6.1.4.1.1206.4.2.6.1.3.1.5	READONLYASCII_STRING
ENGINE_ID	1.3.6.1.6.3.10.2.1.1	READONLYASCII_STRING
ENGINE_BOOT	1.3.6.1.6.3.10.2.1.2	READONLYDWORD
ENGINE_TIME	1.3.6.1.6.3.10.2.1.3	READONLYDWORD
ENGINE_MAX_MSG	1.3.6.1.6.3.10.2.1.4	READONLYWORD

CAN

The M32 has 2 independent CAN ports. CAN1 is configured to communicate at 500kbps with UMRR0C and UMRR11 sensors. CAN2 is reserved.

Take note that CAN-H on the radar need to be connected to CAN-H on the M32 and likewise CAN-L. GND must be connected both sides of the cable to the shield or the ground of the cable.

CAN typically have characteristic impedance of 120 ohm, but due to the scarcity and cost of CAN cable, we recommend using CAT6 cable or better.

Radar sensors with the letter R printed on the label, have an internal 120 ohm resistor. However if CAT6 cable is used, the user must match the resistor with the characteristic impedance of the cable which is 100 ohm. In order to achieve this, add a 600 ohm resistor on both the radar and the M32 ends. This need to be added inside the respective connectors. The maximum cable length for CAT6 at 500kbps is 100 meters.

Data Log to SD card

The log files are named by the date, and contain up to 24 hours of logging data.

The user can configure the following types of data to be recorded:

Network Log (YY-MM-DD.NET):

Network log include network events such as NTP requests, SNMP server requests, HTTP access and FTP access.

Binned Log (YY-MM-DD.CSV):

Data is logged for Speed, Volume, Occupancy, Headway and Gap per vehicle zone, per vehicle class for the interval configured on the TMC. This is typically 5 minutes of 15 minutes. Each entry in the CSV file have a Time corresponding to the time of the M32 the moment that the first packet of statistics is transmitted from the radar. The classes do not correspond to the classes in the TMC, because NTCIP require the class numbers to start at 1, and the M32 can only store 8 consecutive classes whereas the radar have some numbers skipped. Take note of the M32-based classes below.

Class	Type
1	Undefined or class not yet determined
2	Pedestrian
3	Bicycle
4	Motor bike
5	Car
6	Long truck
7	Short truck
8	Van

Per Vehicle Log (YY-MM-DD.PVR):

Per vehicle log include

Field	Description
Time	Time when this vehicle entered the zone
Zone	Zone number corresponding to TMC zones
ID	ID 0-255 given to vehicle for duration of tracking through the radar beam
Class	Vehicle class according to TMC. This is not the same class as the binned log.
Speed	Speed in km/h calculated to 0.1 km/h accurate
Heading	Heading in degrees from -180 to +180 degrees
Length	Length of vehicle in m

Vehicle ID is useful for determining lane changes, or deceleration of the same vehicle during a couple of seconds that the vehicle is in range.

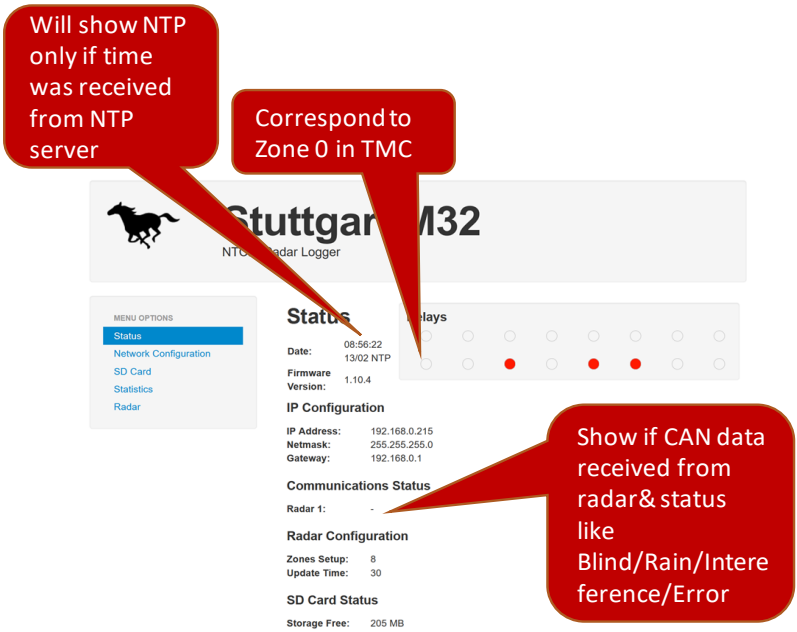
Temperature and Voltage log (YY-MM-DD.VTR):

The controller can log internal temperature which is typically higher than ambient temperature due to components heating up. It also logs voltage supplied to it for power. This is useful if a system is run from a battery. The Stuttgart can record battery voltage.

Web Interface (HTTP port 80)

The main page shows the time from the realtime clock, whether NTP is accessible, the IP configuration, Radar Configuration and SD card status.

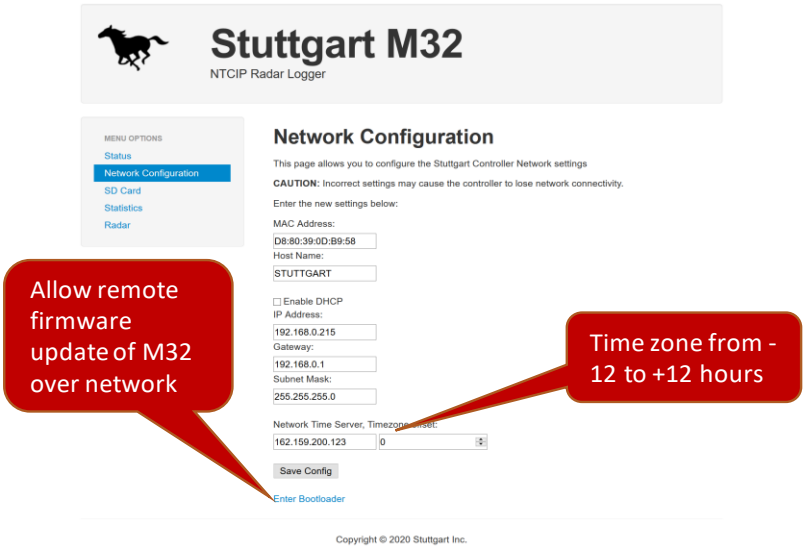
The communication status will move from \ to | to / to – continuously appearing like a rolling wheel to indicate that the M32 is receiving messages from the radar. Next to this indication, it will show if there are any Error status.



The Relay indication correspond with the display on the controller and with the relays in the Smartmicro Traffic Management Configurator. K1 is left bottom and K9 is left top.

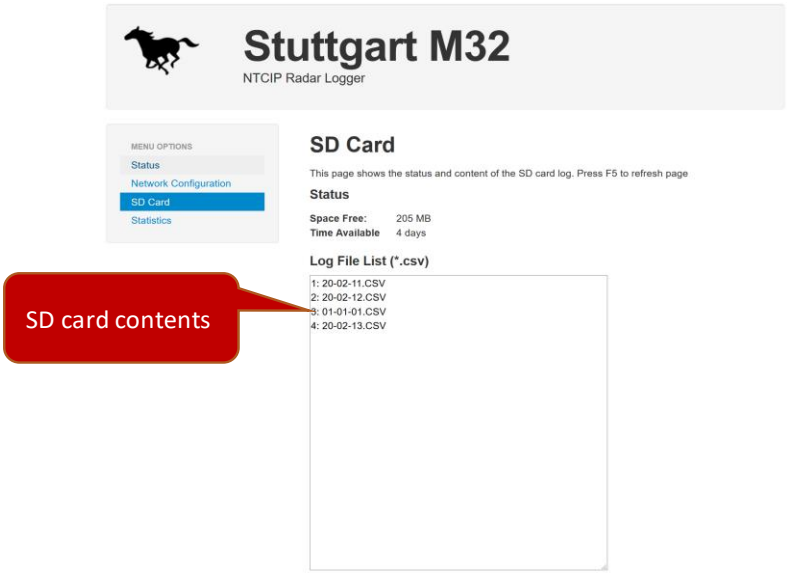
The Network settings page allows you to change network settings. Note that the gateway is only used for outgoing connection on a subnet outside the address/subnet pair shown on the configuration. For example the NTP server will be outside the subnet, and will therefore be routed via the gateway.

Choose “Enter Bootloader” to restart the unit in bootloader mode. Note that you will not be able to ping the controller or access it otherwise for at least 3 minutes thereafter.

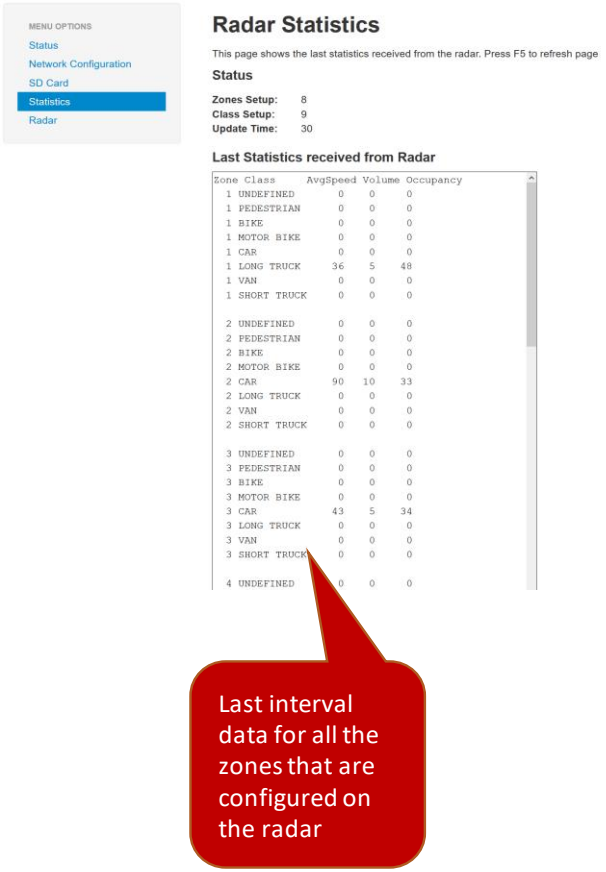


The SD card menu allows the user to see a list of the CSV statistics files that is on the micro-SD card. These files can only be downloaded via FTP.

The user is also able to configure which parameters are recorded to the SD card.



The statistics page shows the most recent traffic statistics, the number of zones configured on the radar and the number of classes the radar supports, as well as the averaging interval in seconds.

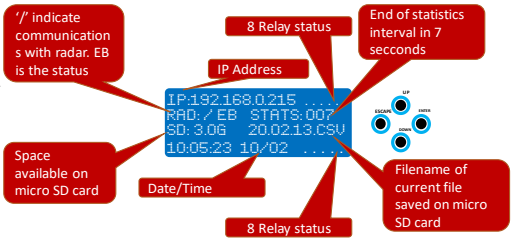


LCD Menu

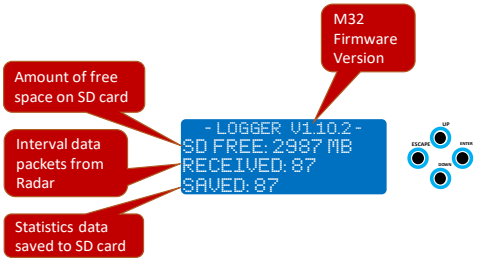
Main Page 1

Button	Description
Up	Next Menu Item
Down	Previous Menu Item
Esc	Main Menu
	Select Option

Status	Description
E	Error
C	Critical
B	Blind
R	Rain
I	Interference

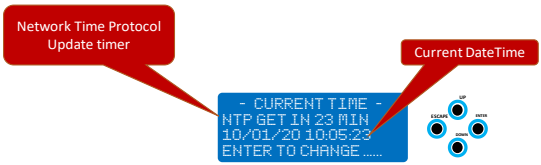


Logger Page 2



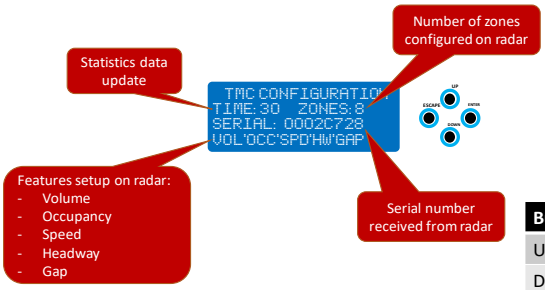
Button	Description
Up	Next Menu Item
Down	Previous Menu Item
Esc	Main Menu
Enter	

Time Page 3



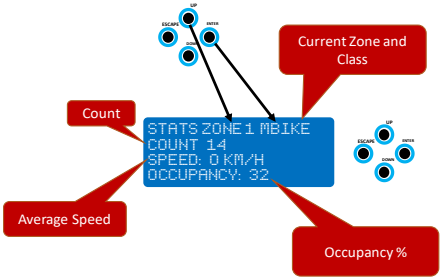
Button	Description
Up	Next Menu Item
Down	Previous Menu Item
Esc	Main Menu
Enter	Change the time

Radar Page 4



Button	Description
Up	Next Menu Item
Down	Previous Menu Item
Esc	Main Menu
Enter	

Statistics Page 5

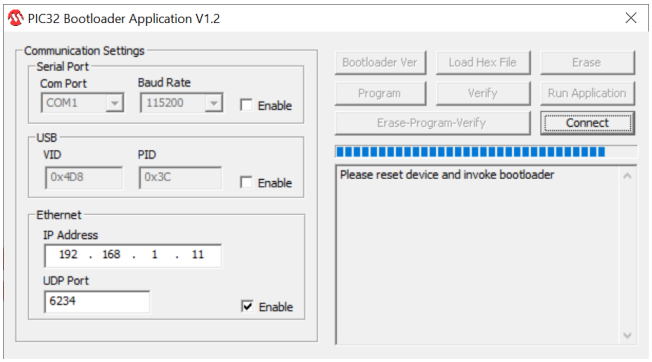


Button	Description
Up	Select next Zone
Down	Select previous Zone/Previous Menu
Esc	Main Menu
Enter	Select next Class

Firmware upgrade through Ethernet (port 6234)

To enter firmware upgrade mode, use the web interface Network Settings page and click on “Enter Bootloader”. You have to connect and start the upgrade process within 3 minutes. The M32 controller will now restart and enter bootloader mode at the same IP address that it was at before. The controller will not respond to ping (ICMP) packets at this time.

Launch the upgrade utility shown below and select “ENABLE” next to Ethernet. Type in the correct IP address.

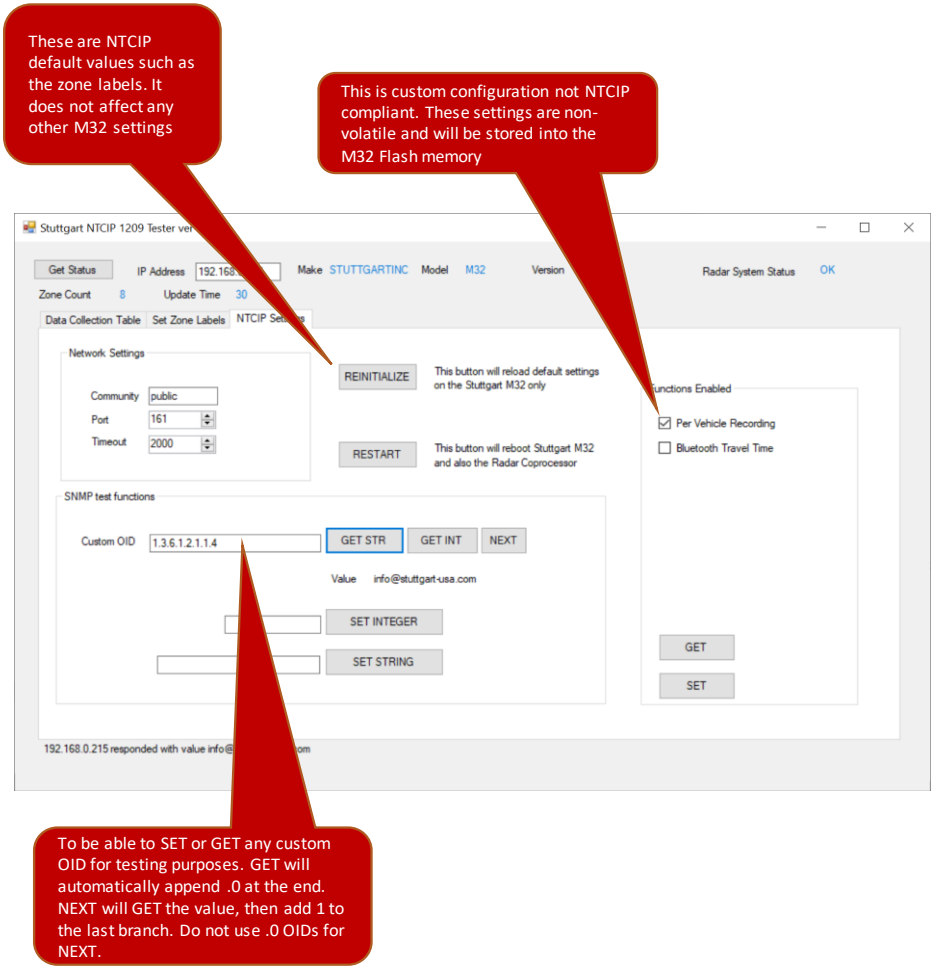


Click on Connect. Once connected the application will show the firmware version of the bootloader program. Now choose “Load Hex File” and select the new firmware file ending with .hex. Select “Erase-Program-Verify”. This process takes approximately 2 minutes and will indicate when done. After completed be sure to choose “Run Application”. The controller will now reboot and launch the application. In the event that the controller enter Bootloader every time after a new application is installed, go to the network settings page, and click on SAVE.

NTCIP Tester

In order to simplify testing of NTCIP objects we offer Windows software to test and demonstrate NTCIP1209 functionality

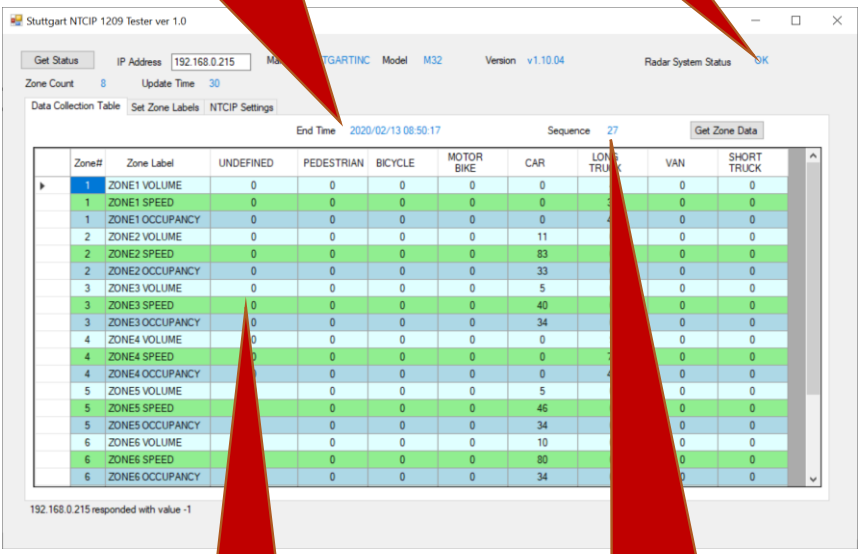
The software has 3 tabs of which the right hand side one allows the user diagnostic tools to restart the controller, or GET/SET custom parameters.



The main page allows the collection table to be retrieved for all the zones/lanes configured on TMC.

Radar Status:
- INITIALIZE
- RADAR MISSING
- INTERFERENCE
- UNKNOWN

The date/time from the M32 Realtime clock or NTP time that the interval of data ended.



Zone#	Zone Label	UNDEFINED	PEDESTRIAN	BICYCLE	MOTOR BIKE	CAR	LONG TRUCK	VAN	SHORT TRUCK
1	ZONE1 VOLUME	0	0	0	0	0		0	0
1	ZONE1 SPEED	0	0	0	0	0		0	0
1	ZONE1 OCCUPANCY	0	0	0	0	0		0	0
2	ZONE2 VOLUME	0	0	0	0	11		0	0
2	ZONE2 SPEED	0	0	0	0	83		0	0
2	ZONE2 OCCUPANCY	0	0	0	0	33		0	0
3	ZONE3 VOLUME	0	0	0	0	5		0	0
3	ZONE3 SPEED	0	0	0	0	40		0	0
3	ZONE3 OCCUPANCY	0	0	0	0	34		0	0
4	ZONE4 VOLUME	0	0	0	0	0		0	0
4	ZONE4 SPEED	0	0	0	0	0		0	0
4	ZONE4 OCCUPANCY	0	0	0	0	0		0	0
5	ZONE5 VOLUME	0	0	0	0	5		0	0
5	ZONE5 SPEED	0	0	0	0	46		0	0
5	ZONE5 OCCUPANCY	0	0	0	0	34		0	0
6	ZONE6 VOLUME	0	0	0	0	10		0	0
6	ZONE6 SPEED	0	0	0	0	80		0	0
6	ZONE6 OCCUPANCY	0	0	0	0	34		0	0

Data Collection Table

Sequence number starts at 0 when M32 is turned on, and continue or roll over at 65535. It increments every time that data is received which is "Update Time" seconds

The labels page allows the user to add labels to the zones or lanes as per NTCIP. These labels are not saved in the M32 controller and the software need to retransmit it after power up: