TTS-MAESTRO

Intersection Controller

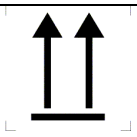
Product Overview & User Manual

CONTENTS

Safety Instructions

	Please read the instruction before using this unit
	Attention ! – High Voltage
	At final disposal of your equipment please ask your local recycle center for keeping applicable regulations
	Attention ! – Please do not remove and/or replace the batteries embedded in the device. Batteries should only be replaced by manufacturer. Unintended use of the batteries can damage the device.

Transportation and Storage Conditions

	Attention ! – Package shall be kept away from rain.
	Attention ! – The device shall be transported and kept with upright position.

Intended Use

Maestro intersection controller is a multiprocessor controlled system consisting of several electronic modules with embedded software and standard sized metal cabinet, developed by Teknotel. This product has been thought to keep the traffic movement flowing.

Maestro consists of electronic modules (with embedded software), power protection devices, cable terminals and a cabinet to encapsulate all of these.

1. Mechanical Construction

Maestro has a iron cabinet epoxy painted color code RAL 7032. Stainless steel cabinet and other RAL coded color options are available on request. Iron or steel cabinet is preferred to meet the EMC requirements.

The controller designed with CMOS Technology, all printed circuit boards the components based on produced double layer. All modules are installed in a aluminum racks fixed on a swing frame inside door (see figure 1 and 2 below) to provide easy maintenance and installation. Therefore supply without cabling and/or housing is available on request.

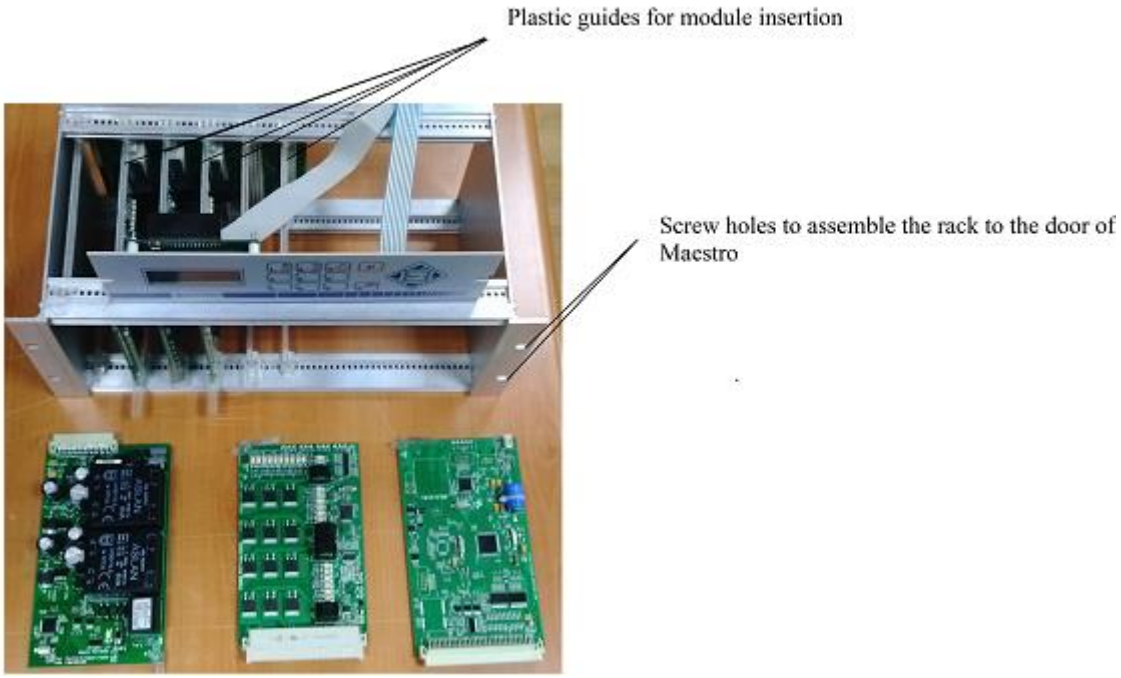


Figure 1: Aluminum module rack

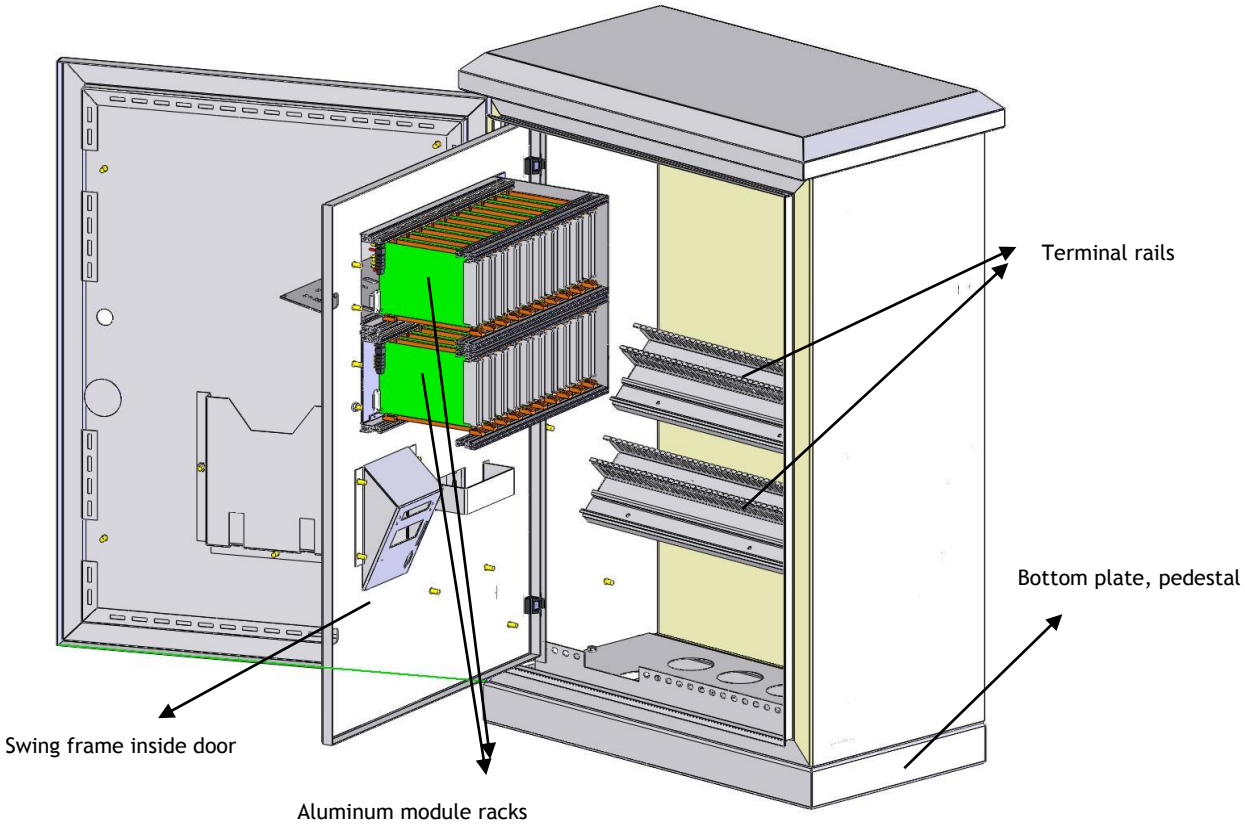


Figure 2 – Swing frame door

The cabinet meets the protection against water and dust at IP54 ingress degree. Additional three point locking system and hidden hinged provide a strong resistance against vandalism. Cabinet with double door is available on request. The second part is used for power connection and electricity meter.

The controller should be installed on a concrete base. In order to easy installation the pedestal has to be mounted first, subsequently the controller can be fitted via screws.

Additional features written below help the technician to maintain easier;

- Door stopper in case of windy weathers during maintenances and commissioning
- Different connector types for each kind of modules, consequently the modules can not be inserted in a false position.
- Plastic extractors and retainers for easily plug/unplug of the modules

2. Electronic design

Modules are designed preponderant with CMOS technology. Each module has their own micro controller communicates with central processor module. The components are accommodated on double layer printed circuit boards.

Below is a block diagram that shows the connection between electronic modules and the connection to the electric network.

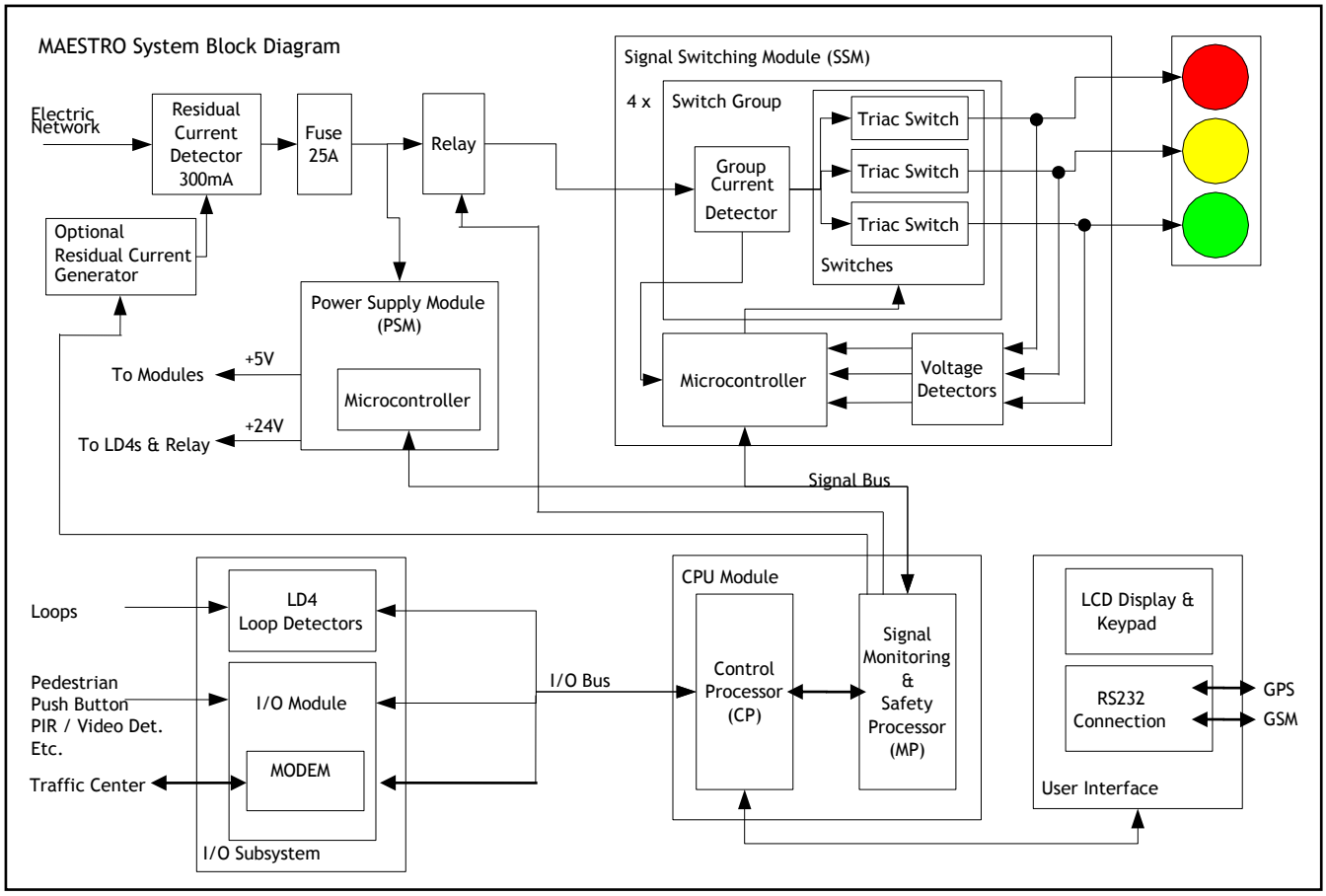


Figure 3 – System Block Diagram

Modules are designed in Europe size. Each kind of module has a different type of connector to avoid plug in a wrong place.

The types of electronic modules in the system is as follows:

- Power Supply Module – PSM
- Signal Switching Module – SSM
- Central Processing Unit Module – CPU
- Backplane module for CPU, SSM, PSM modules - BP
- Input/Output Module - IOM
- VEK Loop Detector Module – M4D
- Backplane module for IOM and LD4 modules – IOBP
- Man Machine Interface Module – MMI
- Touch Screen Interface - TSI

2.1. **P**ower **S**upply **M**odule – PSM

PSM has their own micro controller, which communicates with CPU via CAN bus. PSM module has to be installed per rack and supplies the low voltages all the electronic modules need.

- Module has two redundant transformers, each one has a capacity to supply all modules installed in a rack in case of failure one's
- produces the power controller needs, 5V DC/3A and 24V DC/0,5A
- equipped with a 32-bit micro controller support CAN protocol
- monitors main supply, DC currents and voltages, promptly reports the voltage drops and peaks in order to keep the operation of the controller in safe voltage limits
- informs the state of the door to the CPU module
- controls heater and fan (heater and fan are optional features, and done only by the first PSM)

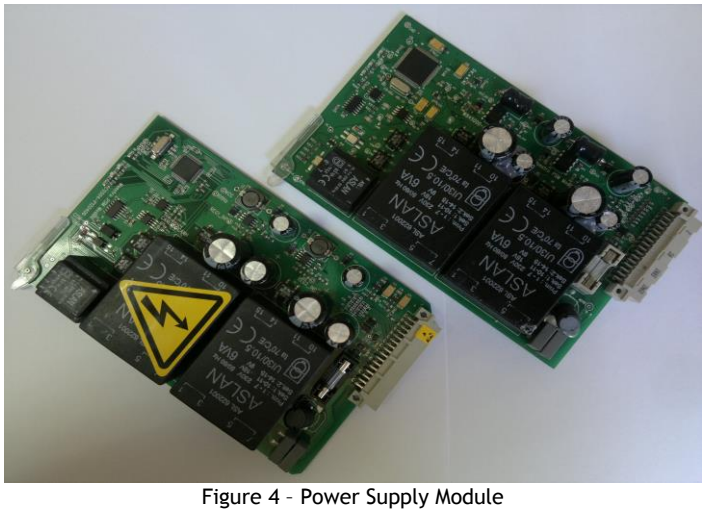


Figure 4 – Power Supply Module

2.2. **S**ignal **S**witching **M**odule – SSM

The main task of this module is to drive the lamp outputs according to the commands coming from CPU module. SSM has their own micro controller, which communicates with CPU module via CAN bus.

- Each module has 12 lamp output circuits, this signal outputs have to be configured as signal groups, can be defined as 1 aspect (flasher, green arrow, continues red), 2 aspect (pedestrians, flasher), 3 aspect (vehicle, tram, cyclist) signal heads.
- Lamp monitoring is done by the SSM module and reported to the CPU, SSM is able to monitor incandescent, halogen and LED signal heads (min 12 W) for each output
- Each output has a voltage monitoring circuit
- Each signal group (a vehicle signal group (red, amber, green)) has a current monitoring circuit,
- equipped with a 32-bit micro controller support CAN protocol
- Spontaneously flashing ability with stored colors in case of absence or malfunction of the CPU.
- there are colored led indicators for each signal outputs to observe the signal sequence
- each output has a driving capacity 2 A at 230V AC
- “zero crossing” method to switch the lamp outputs
- lamp driver circuits are optical isolated from low power supply of the controller

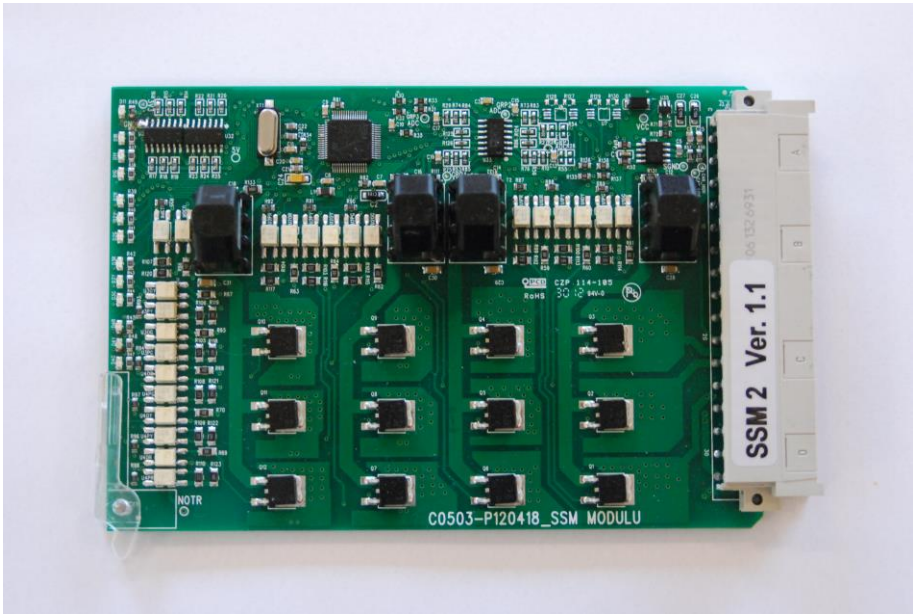


Figure 5 – SSM Module

2.3. **C**entral **P**rocessing **M**odule - CPU

CPU module has two 32 bit microprocessor, one of them is responsible for the safe signalization (MP – monitor processor), and the other (CP – control processor) serves

for the other operational tasks. By having CP for signal program processing, and MP for signal monitoring, functions of deciding the signals to display, and checking if displayed signals are safe, are separated.

CP communicates with detector modules, input/output modules, LCD display – keypad modules and traffic center.

The communication with the SSMs and PSMs is done by MP. On the bus, MP acts as a master and initiates the communication. It gets the signaling information from the CP, checks it, and if appropriate sends them to SSMs. As response from the SSMs, MP receives the current and voltage measurement results of signal outputs. Upon this information it checks the condition of the intersection and takes action to prevent unsafe signaling, if it detects any.

- 32 bit dual processor technique
- Two RS 232 serial ports to communicate with peripherals (PC, GPS, GSM, etc.)
- battery buffered real time clock

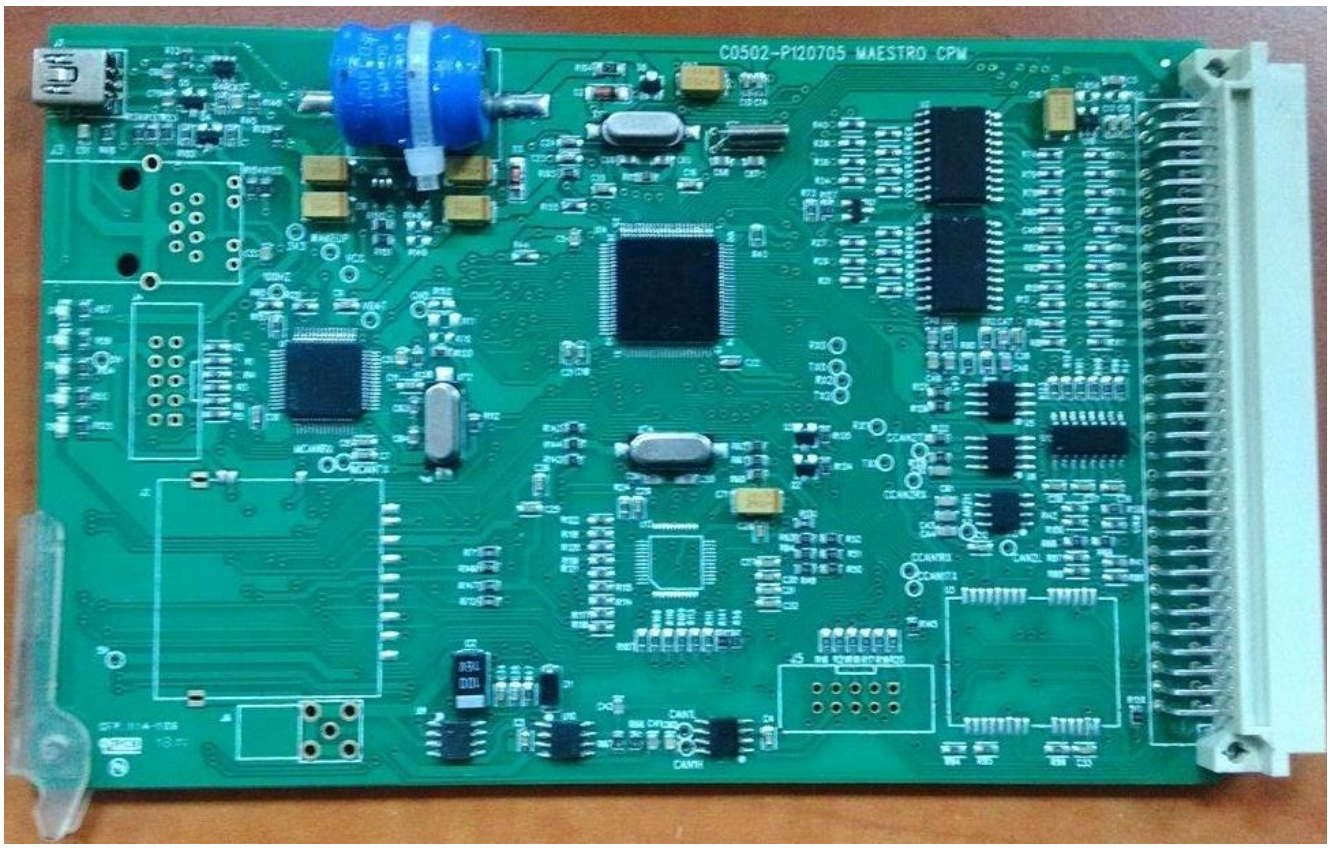


Figure 6 – CPU Module

2.4. **SSM B**ack**p**lane Module – SSMBP

This module consist of connectors, which the modules (SSM, CPU, PSM) plug in and provide the input/output connections to the terminals or to the Detector Backplane.
The module is installed on the aluminum rack in order to carry up to 1 PSM, 1 CPU and 4 SSM modules. The current supplies to the signal heads flow through a relay located on the Backplane, this relay is controlled by MP. If there will be an insecure signalization on the intersection, MP shut immediately the signal heads down (less than 300 ms.)
An aluminum module rack can be fitted only with one SSMBP.

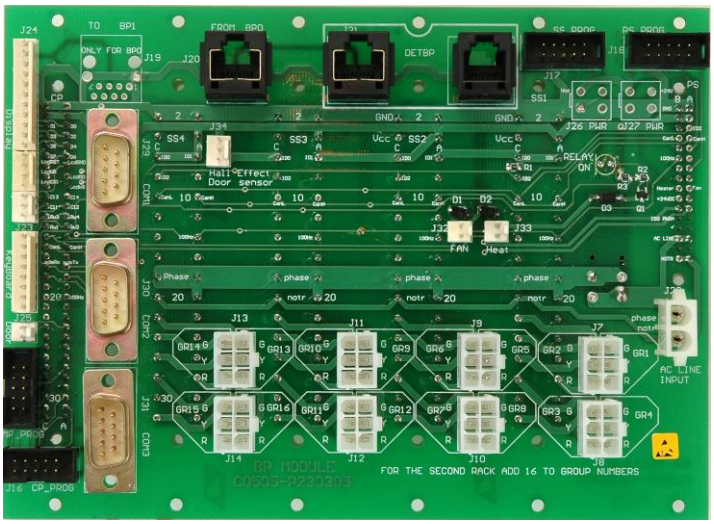


Figure 7 – SSM Backplane

2.5. **I**nput/**o**utput **M**odule – IOM

I/O Module is an optional module to obtain the external demands and to transmit the acknowledgements.
This module provide the input/output connections of the controller such as pedestrian push buttons, PIR Detectors and Loop Detectors (LD4 Module) and the connection to the traffic center done by the modem installed on the I/O Module.

- Module has a own micro controller, evaluate the inputs and transmit to the CPU module via CAN bus. In the same way I/O module receives the commands from CPU module and transmits them to the outputs.
- Module has 16 inputs and 8 outputs, all inputs and outputs are electrically isolated. Inputs and outputs are open collector circuits; outputs can supply 5mA at 12V DC.

2.6. **M4D** Loop Detector Module – M4D – VEK

In the new controller can be used M4D loop detector module, which has 4 channel loop detector inputs. All inputs are adjustable for variant frequency range and sensitivities for different kinds of vehicles.

Figure 8 – VEK M4D

2.7. **B**ack**p**lane module for **IO**M and Det. modules – IOBP

It is an optional module used for to connect LD4 modules and I/O module.

- Up to 4 Det. modules and one I/O module can be installed on each IOBP.
- An aluminum module rack can be fitted only with one IOBP, in case of necessities more than 16 loop detectors, should be installed second aluminum rack.

2.8. **M**an **M**achine **I**nterface Module – MMI

MMI module is used to supply the basic data to the controller, to check the traffic programs stored in the controller and to observe present running state of the controller on the display. (For MMI user manual please have a look the document MMI User Manual)

- There is an easy touch membrane keypad with numeric and function keys.
- a back lighted LCD display is controlled by CPU module.
- Synchronization points are indicated on the display. (Sy, Fo, etc.)
- The demands comes from traffic (loop detectors, opto isolated inputs) users are displayed on the screen.

Figure 9 – Man Machine Interface Module

3. Modes of Operation

Maestro can support two operation methods. Phase control method (see 4.3 and 4.4) and sequence (step) control method (see 4.6). For each method Maestro can support the operating modes described below.

3.1. DARK Mode

In case of an insecure signalization like green conflicts, controller shuts down the relay in order to prevent current transmitting and the signal heads do not illuminate.
Dark mode can be added to the daily working list as well.

3.2. FLASHING Mode

Signal groups blink with the predefined flashing colors, blinking frequency is adjustable by user. Flashing mode can be added to the daily working list as well.

3.3. FIX TIME

Controller runs with the transitions from one phase to another are previously defined with fixed phase durations or controller runs in a sequence, it has a fixed period duration and consist of steps.

3.4. WIRELESS COORDINATED

Maestro Controllers have the same time source by using a GPS module at each one, because the time telegram is transmitted by satellite. The controller gets the time signal every second from GPS module, calculates the actual time from midnight of the current day, so the controllers run in green wave.

3.5. CENTRAL COORDINATED

Maestro Controllers will be able to connect to the Sitraffic Central and Lilliput Urban Traffic Center. Controller sends the various message types to the center like lamp faults, power down, traffic counts, voltage drops and peaks, actual operating status, conflicts, signal plan up/download, door open/closed etc. which are archived in the log memory of the controller up to 1024 line.

3.6. TRAFFIC ACTUATED

Controller runs accordingly the demands came from the sensors installed on the street, like pedestrian push buttons, PIR detectors, loop detectors. Please find the parameters used in the traffic actuated programming in section 4. In phase control method Maestro changes the running phase and in sequence control method Maestro changes the running sequence accordingly the demands came from traffic users. For each method demands are evaluated in the lojik blocs predefined by user. Then Maestro decides to jump to the convenient phase or sequence or keeps its status and runs the same state until a lojik bloc will true.

4. Data Structure

4.1. Signal Outputs

Controller has a capacity of max. 96 signal outputs, which should be grouped as signal groups, max 32 signal groups can be defined.

- Physical address; the number of the output circuit of SSM module assigned for the signal output.
- Type; this is the color definition of the signal output, none, red, amber or green. Outputs can be assigned freely for different signal colors.
- Lamp amount; the amount of the lamps connected to the output should be given in order to monitor all lamp types like E27, halogen and LED (min 12W).
- Lamp type; the type of the lamps connected to the output should be given in order to monitor (E27, halogen or LED).

4.2. Signal Group

A signal group is the construct that a signal can be assigned to. Then, the signal outputs that are owned by the signal group should be activated or deactivated accordingly to realize that signal at the intersection. Signal group constructs have the following attributes:

- SG number: The number used to refer to this signal group.
- Type: This can have a value of MAINWAY VEHICLE, SUBWAY VEHICLE, PEDESTRIAN, BICYCLE, TRAM or FLASHER. A FLASHER signal group alternatively activates and deactivates its outputs without the need of a signal assignment.

- Opening signal: The signal to display at this group, before this signal group will display the right-of-way signal, when this signal group is displaying blocking signal. (for instance Red+Yellow)
- Opening duration: The duration in seconds to display the opening signal.
- Closing signal: The signal to display at this group, before this signal group will display the blocking signal, when this signal group is displaying the right-of-way signal. (for instance Yellow)
- Closing duration: The duration in seconds to display the closing signal.
- Flash signal: The signal to be displayed at this signal group in flashing mode.
- Green Flash Duration: The duration in seconds to display green flash signal after green signal before closing.

Max. 32 signal groups can be defined.

4.3. Phase

A phase is a construct that defines a state of the intersection in which certain signal groups will get GREEN and others will get RED.
A phase has the following attributes:

- Phase Number: The number used to refer to this phase.
- Group list: Signal groups that will have the right of way in the phase.
- Minimum duration: The minimum duration that the controller should remain in this phase before a transition begins.

Maximum 16 phases can be defined.

4.4. Phase Transition

A phase transition construct is used to represent the time the intersection stays in a phase and the action of switching to another phase. There can be 96 phase transition structures in the controller.
A phase transition has the following attributes:

- Phase transition number: The number of this transition construct.
- Current Phase: The number of the phase that the transition will begin in.
- Target Phase: The number of the target phase.
- Min Green To Target: Minimum green duration that should elapse in the current phase before switching to target phase.
- Max Green At Current: The green duration at the current phase after which the demands from the detectors cannot extend the current phase.
- Simultaneous Closure Flag: Flag indicating if the signal groups of the current phase should lose right-of-way simultaneously.

- Simultaneous Opening Flag: Flag indicating if the signal groups of the target phase should acquire right-of-way simultaneously.
- Demand for Target Phase Logic Block: The number of the logic block that decides if a need to switch to target phase has occurred.
- Staying in Current Phase Logic Block: The number of the logic block that decides if a need to stay in the current phase is present.

4.5. Signal Plan

A signal plan is a fixed timed signaling period, which is made up of phase transitions with fixed green durations. The rule blocks of the transition constructs are ignored while working according to a signal plan. Instead, a transition concludes after the given fixed green duration. There may be 16 signal plans defined and stored in the device. A signal plan has the following attributes:

- Number used to refer to this signal plan.
- Validity flag indicating that the all data of the signal plan is valid and the controller may work according to this signal plan.
- The number of phases in the signal plan.
- The number of the each phase transition in the signal plan.
- The green duration of each phase in the sequence in seconds.

4.6. Signal Sequence

A signal sequence is a sequence of timed states of the signals at the intersection (called signal steps). A signal step has the following attributes:

- Number used to refer to this signal sequence.
- Number of signal steps comprising the signal sequence. A signal sequence can contain maximum 48 signal steps.
- The duration of each signal step in seconds.
- The signals at each signal group in each signal step.

Max. 8 signal sequences can be defined.

4.7. Switch-on and Switch-off sequences

One of the previously defined signal sequences can be assigned to be used as switch-on sequence and another for switch-off sequence. If no signal sequence number is assigned (or 0 is assigned), the controller will operate without displaying a switch-on or switch-off sequence.

4.8. Flash Period

This is the duration of an on/off cycle of a flashing signal in milliseconds. Default value is 2000 (yielding 1 second on, 1 second off). May be:

- 1000
- 2000
- 4000

4.9. Work Schedule

Work schedule is a table that corresponds dates with daily working plans. A work schedule can have maximum 16 entries. Each entry has the following attributes:

- Start Date: The first date of the work schedule entry. This field may have a value of a weekday instead of a date. In such case, the work plan applies to all mentioned weekdays and finish date is meaningless.
- Finish Date: The last date of the work schedule entry.
- Daily Work Plan Number: The number of work plan to apply within these dates.

4.10 Daily Work Plan

This structure includes the information on how the controller should work according to the hours of a day. There can be maximum 16 entries in a daily plan and there can be maximum 16 plans defined. A daily working plan has the following fields in each entry:

- Number: The number used to refer to this daily work plan.
- Time: Time of the day at which the controller will start working in the working mode mentioned.
- Working Mode: This field can have one of the following values:
    - DARK
    - FLASH
    - Fix Time
    - Wireless Coordinated
    - Central Coordinated
    - Traffic Actuated
        - SPx: The controller should work according to signal plan numbered ‘x’.
        - SQx: The controller should work according to signal sequnce numbered ‘x’.

5. Data Supply Tool - Maestro User Tool

Maestro User Tool is a Windows® based user friendly data supply tool, data needed for programming of the Maestro can be supplied with Maestro User Tool. It connects to the controller through a female 9 pin D-Sub connector located on the CPU module (RS 232 serial port) or Mini USB cable, uploads and downloads the data of the intersection. (For user manual please have a look the document Config Tool User Manual)

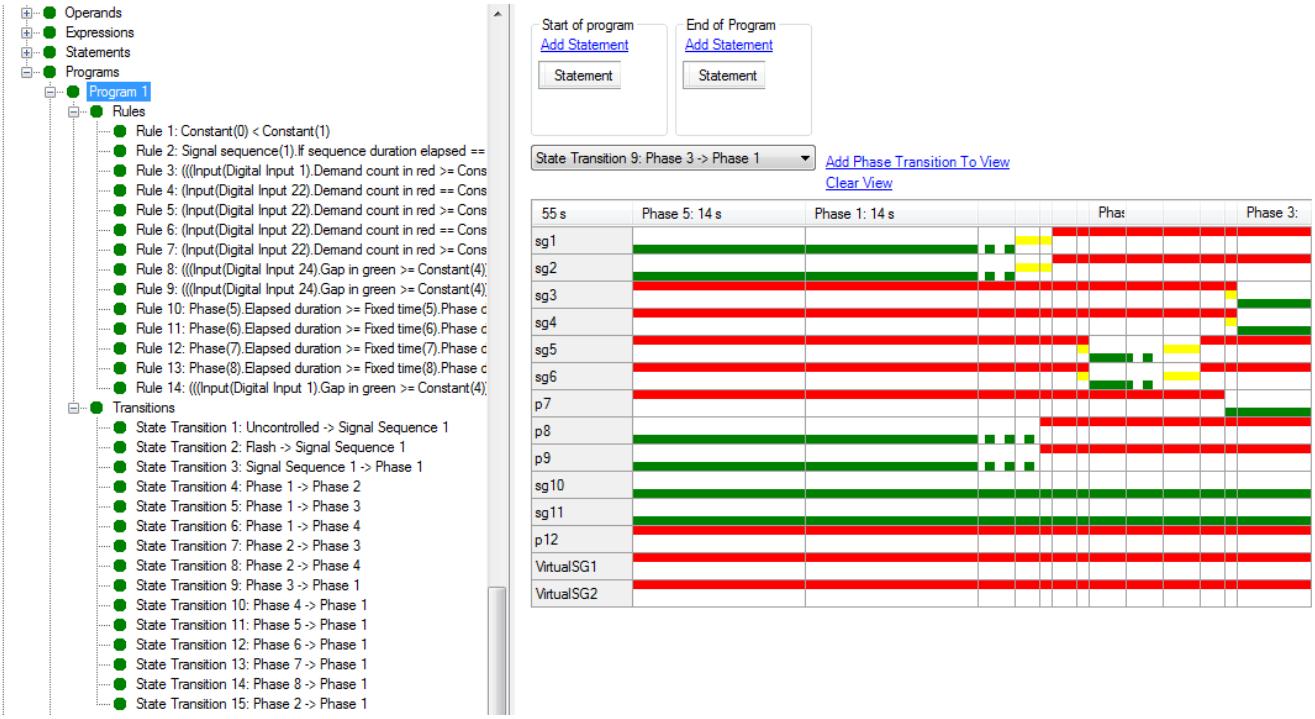


Figure 9 – A frame of Maestro User Tools

6. Configuration Options

Maestro Intersection Controller has three commercial types as to signal group capacity. According to customer requirements Maestro can be equipped up to 32 signal group outputs, 32 loop detector inputs, 32 opto isolated inputs and 16 outputs. PSM, CPU and SSM are fix modules have to be installed to operate the controller. MMI, TSI, I/O and M4D are optional modules, as well as the low current cabling, available on request. Below is the list of the configuration options with the modules can be installed on the device.

Figure 10 – An extended configuration of Maestro

Maestro Type (Small) can be equipped up to 8 SGs. No loop detector connection is available. Pedestrian push buttons and PIR Det. connections are available on request.

- 1 CPU
- 2 SSM (8 signal groups)
- 1 PSM
- 1 I/O Module
- 1 MMI Module

Maestro M Type (Medium) can be equipped up to 16 SGs. Loop Det., PIR Det., Manuel operation and pedestrian push button connections available on request.

- 1 CPU
- 4 SSM (16 Signal groups)
- 1 PSM
- 1 I/O Module
- 1 MMI Module
- 4 Loop detector modules (16 loop detector inputs)

Maestro X Type (Extended) can be equipped up to 32 SGs. Loop Det., PIR Det., Manuel operation and pedestrian push button connections available on request.

- 1 CPU
- 8 SSM (32 Signal groups)

- 2 PSM
- 2 I/O Module
- 1 MMI Module
- 8 Loop detector modules (32 loop detector inputs)

7. Operational Futures

Maestro Intersection Controller was improved according to the customer necessities. Some specifications and conveniences for users are listed below;

- controls up to 96 signal outputs, freely configurable up to 32 signal groups for any traffic movement (the amount of the signal outputs assigned for a signal group can be changed on requirements)
- enable to connect up to 32 loop detectors
- enable to connect up to 32 isolated inputs and 16 isolated outputs
- all inputs as well as loop detector inputs are convenient for counting and measuring of occupation rate
- two RS 232 ports allow to connect various peripherals (GPS, GSM, PC, etc)
- up to 16 different phases can be defined, with the combination of the predefined phases can be prepared 16 signal plan
- Up to 16 different signal sequences can be defined, which is consist of max 48 steps with fixed durations.
- rules based phase transition method in Traffic Adaptive Operation, the rules can be prepared through Maestro User Tool with the parameters like “phase durations, signal durations, traffic volume, occupation, demands from actual traffic, gap durations, waiting durations etc”, this rules can be linked with the logical parameters (and, or, less than, equal, etc.) and supplied through the Maestro User Tool.
- phase transition frames can be created by the controller automatically
- switch on and switch off sequences,
- operating system upgrading through COM port, performed by the user with no need for other components
- simulation of the signal plans without lamp outputs to avoid insecure and faulty signalization
- standard or malfunction flashing patterns and flash frequency

8. Traffic Safety – Secure Signalization

Before the signals are shown to the traffic users, they were checked by the MP – Monitoring Processor according the rules below defined in EN norms;

- a separate micro controller for safety checking
- command monitoring of each color
- conflict monitoring of the enemy signal groups according to predefined conflict matrix
    - green to green
    - green to yellow
    - yellow to yellow

- lamp failure monitoring for each signal output
- lamp failure monitoring in flashing mode as well
- operation voltage monitoring
- supervision of the durations (phase and phase transition durations)
- insecure signaling prevention, signal sequence monitoring
- compliancy checking of the signal group outputs, signal pattern monitoring
- watchdog function, for monitoring of the controller operations
- deactivation (malfunction flashing or all dark) time is <300 ms
- switch on and switch off sequences
- simulation of the signal plans without lamp outputs to avoid insecure and faulty signalization
- stand-by or malfunction flashing patterns and flash frequency

The functional safety rules and norms defined with EN 12675, which meet the controller, are listed below in figure 11.

Concept	EN12675	Class
Green-green conflict	4.5.1.a	AA1
Green-yellow conflict	4.5.1.b	AB1
Yellow-yellow conflict	4.5.1.c	AC1
National signal regulations (infringement)	4.6.a	BA1
Stand-by mode (flashing signals)	4.6.b	BB1
Failure mode (flashing signals)	4.6.c	BC1
Absence of a red signal on a specified signal group	4.7.1.a	CA1
Absence of the last red signal	4.7.1.b	CB1
Absence of a number of red signals	4.7.1.c	CC1
Absence of specified red signals	4.7.1.d	CD1
Absent signal group, yellow or green signals	4.7.2	CE1
Compliance checking	4.8	DA1
Stored values of timing	4.9.a	FA1
Minimum values of time settings	4.9.c	FC1
Maximum values of time settings	4.9.d	FD1
National signal sequences (infringement)	4.10.a	GA1
Faults of external inputs	4.11	HA1

Figure 11 – Clauses of EN 12675, which meets Controller

9. Event and Failure Log

Maestro Intersection Controller is able to log in real time the events occur in the intersection. This logs can be viewed via MMI module display installed on the controller or they can be downloaded from the controller via Maestro User Tool Tool. Some futures of event data base listed below;

- failures or events are logged in a cycling data base up to 1024 record
- they are stored in flash memory with date and time when they occurred
- they are reported via GSM modem to a GSM phone or a SMS center by sending a short message. Events and failures are sent simultaneously to the UTC, too.
- information stored ;

- signal plan switching times,
- lamp failures / corrections with color and signal group information,
- voltage drops / peaks,
- door open / closed,
- power down / up,
- operation mode changing,
- data memory failure,
- timing and duration failures,
- conflicts,
- defective modules,
- signal sequence infringments
- telecom line failures / corrections,
- loop detector failures / corrections

10. Montage and Erection

The device should be installed on a concrete base in a vertical position. Please make sure that the concrete base is made of according to the drawing in Annex 1.

Use these PE terminals to connect the intersection controller to the earth (concrete foundation)

11. Commissioning

The device should be commissioned and taken into operation by an authorized staff.

Commissioning should be made under supervision of traffic police.

Please find the terminal lists with fuse for cable connections in Annex 2.

Power supply cable of the device should be at least 6mm^2.

Please follow the instructions in the file Annex 3.

12. Maintenance

The device should be maintained by an authorized staff periodically according to the instructions in Annex 4.

	Attention ! – High Voltage In case of a maintenance even you switch off the unit, there might be high voltage at the terminals and in some locations. The maintenance should be done by skilled and trained personnel.

13. Disposal of this intersection controller

This unit should not be disposed as unsorted municipal waste after the normal usage. For the latest legal regulation local authorities should be contacted how to dispose this unit in compliance with 2002/96/EC WEEE (Waste on Electrical and Electronics Equipment).

14. Battery change:

The electronic CPU card inside the unit is equipped with rechargeable battery. The expected life of this battery is approximately 3 years. In case of change of the battery needed this should be done by Teknotel authorized technician.

15. Battery Removal:

The battery should be recycled and disposed in accordance with local regulations.

16. Safety compliance with the European Directives:

Our intersection controller MAESTRO is in compliance with the following European Directives:

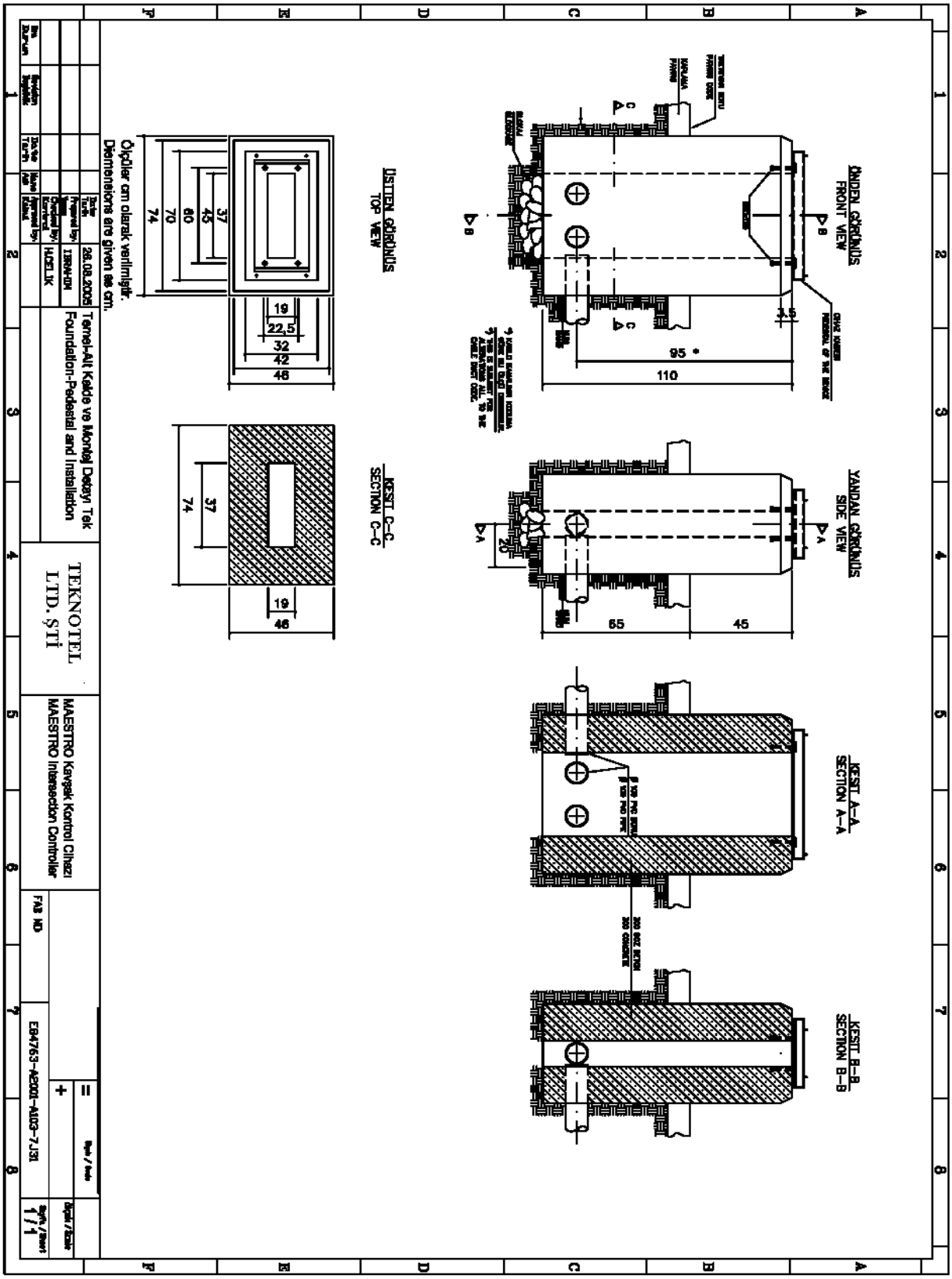
2006/95/EC Low Voltage Directive

2004/108/EC Electromagnetic Compatibility

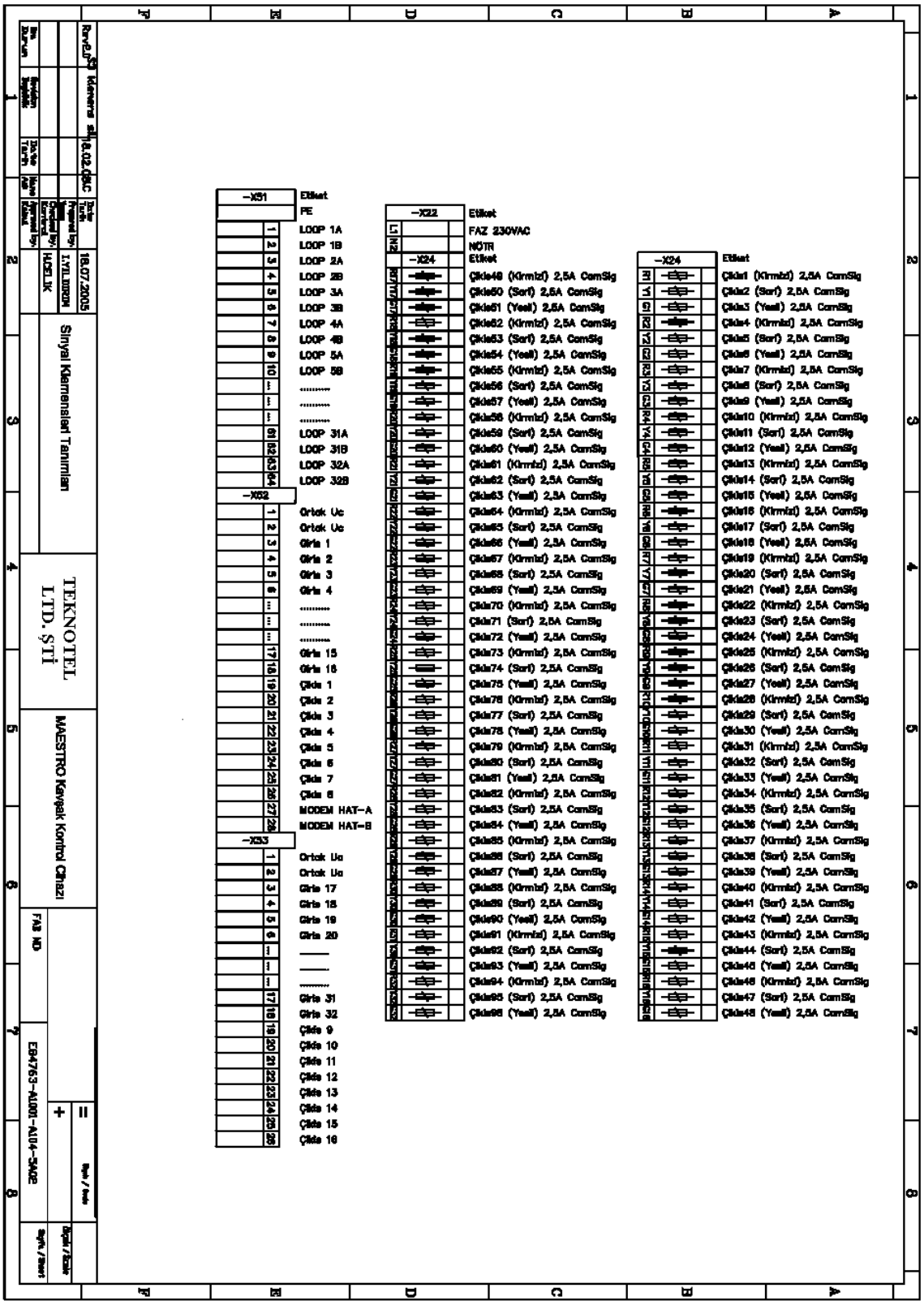
17. Maestro Controller Technical Data

Power supply	220VAC +/- 20% 50Hz +/- 4%
Signal lamp voltage	220VAC standard (42VAC option)
Max. Power consumption	20A max for total lamp current
Power per channel	2A max 5W minimum
Applied standards	HD638, EN12675, EN60529
Operating ambient temperature range	-25 ºC... +55ºC
Power consumption	Controller part 30W max
Supply interruption	Up to 50 ms continuous operation
Supply failure	Automatic restart without operator intervention
Control architecture	Full electronic design, 32 bit main processor, 32 bit control processor 256MB RAM, 2GB of flash memory
Lamp switches	12 lamp outputs per module, 96 lamp outputs at full scale, All outputs with current/voltage measurement Continuous self-supervision
Lamp types	Standard incandescent lamps, halogen lamps, LED lamps
Flashing cycle	1 or 2 Hz, individually selectable per output
Pushbutton inputs	Up to 32 galvanic isolated pushbutton inputs
Detector inputs	Up to 8 detector modules with 4 channels each, configurable fault monitoring for continuous occupancy.
Other interfaces	2 serial RS232 ports, USB and Ethernet interfaces 10/100 Mbit
User operation	Internal graphical 3,2” TFT full color touch screen display, External via Windows PC
Program and parameter supply	Locally by XML supply files Remotely by MAESTRO TKM Server
Time standards	Mains, RTC, GPS, NTP
Traffic-related parameters	Up to 32 signal groups, Free allocation to up to 3 independently switchable partial nodes, Manual/Fixed-Time/Vehicle Actuated operating
Operation modes	Central control, local signal plan choice, manual operation, coordination, annual automatic, autonomous control, green wave
Switching on and off	Different switch-on and switch-off programs Freely configurable signaling sequences Free assignment of switch-on and off programs to signal plans
Signalling status monitoring	Dual-channel signaling monitoring according to EN12675 Continuous switch-on and switch-off program monitoring Self-monitoring sensors with continuous plausibility check for bulb current and voltage, signaling state and conflict monitoring
Software	Operating system: microC/OS-II
Heater for cabinet	30W PTC (optional)
Dimming	Optional
Dimensions	950 X 650 X 400 mm
Weight	95kg

ANNEX 1 (Foundation Pedestal & Installation)



ANNEX 2: Terminals Definitions



ANNEX 3 (Page 1)

MAESTRO INTERSECTION CONTROLLER COMMISSIONING FORM

Customer	
Relevant Personnel Name-Surname Adress/Phone/Fax/E-mail	
Name/Location of the Intersection	
Installation Period (hours)	

CONTROLLER TYPE & WARRANTY NUMBERS						
DEVICE TYPE – SERIAL #	SOFTWARE VER.	PSM NO	SSM NO	CPU NO	MMI NO	DED.NO
BASIC ☐ EXTENDED ☐						
SSM BACKPLANE NO				IO BACKPLANE NO		IO NO

INSTALLATION DATE	WARRANTY START DATE

MEASURE THE LINE VOLTAGE VALUES		
PHASE - NOTR	PHASE – GROUND	NOTR - GROUND

DAILY WORKPLAN LIST					
List Numbers for Weekdays / / / / / /					
List 1		List 2		List 3	
00:00	Mod S P	00:00	Mod S P	00:00	Mod S P

TEKNOTEL Supervisor		CUSTOMER	
Date :		Date :	
Signature :		Signature :	
Name :		Name :	

ANNEX 3 (Page 2)

MAESTRO INTERSECTION CONTROLLER COMMISSIONING FORM

Name/Location of the Intersection	
Has the Intersection Been Installed Recently	

CHECK PLEASE

1. Main supply cables should be at least 6mm². ☐
2. Phase and Notr connections are correct. ☐
3. All clip lines are fastened tight. ☐
4. The case or the paint of the device is undamaged and faultless. ☐
5. The leakage current switch is tested using test button ☐
6. Device base is hardened fixed ☐
7. Signal Security Tests are made ☐
8. Grounding is checked ☐
9. The lamp is mounted ☐
10. Module rack front panel fasteners are tight ☐
11. The signal program is tested at trial mode ☐

THE PROBLEMS OCCURED DURING INSTALLATION Replaced Units, Cables, Fuse, parafadur, Clip lines, Voltage, Base Mounting Problems and etc.)

TEKNOTEL	
Date :	
Signature :	
Dealer :	
Name :	

ANNEX 4 (Page 1)

PERIODICAL MAINTENANCE and TEST INSTRUCTIONS

Customer Information	
Name and location of Intersect. / Contr. Type	
Date – Time - Duration	
Police Supervision	YES ☐ NO ☐

A. CONTROLLER

a. Mechanical and exterior inspection

1. Oiling of the hinges and the lock (12 months)..... ☐
2. Inspect the paint and housing (6 months)..... ☐
3. Inspect the foundation (6 months)..... ☐
4. Replace the bulb (max 60W) in the controller (6 months)..... ☐

b. Traffic Safety & Functional Checks

1. Random traffic safety inspection (6 months)..... ☐
2. Traffic safety inspection according to the conflict matrix (24 months)..... ☐
3. Check the cycles of the signal plans (24 months)..... ☐
4. Flash operation in case of critical failure (12 months)..... ☐
5. Switch on and switch off sequences (24 months)..... ☐
6. Duration of the opening and closing signals (24 months)..... ☐
7. Manual operation modes (Flash, All Red, Dark) (12 months)..... ☐
8. Daily work plans (12 months)..... ☐
9. Keypad functionality (12 months)..... ☐
10. Loops, pedestrian push buttons, above ground sensors (12 months)..... ☐

c. Electrical Inspections and Tests

1. Residual circuit breaker (with the test button) (6 months)..... ☐
2. Dangerous Voltage Limit for Human touch < 50V (24 months)..... ☐
3. Check the earth connection (12 months)..... ☐

d. Documentation

1. Completed and up to date (24 months)..... ☐

TEKNOTEL Maintenance Team		CUSTOMER	
Date :		Date :	
Sign. :		Sign :	
Name :		Name :	

ANNEX 4 (Page 2)

PERIODICAL MAINTENANCE and TEST INSTRUCTIONS

B. EXTERNAL SYSTEMS

1. Replacing the bulbs and cleaning the reflector of the Signal Heads (E27 4 months, halogen 8 months)..... ☐
2. Cleaning of the lenses (depends on location, 4 - 6 months)..... ☐
3. Inspection of the fitting and direction of the signal heads and sensors (12 months)..... ☐
4. Inspection of the rubber gaskets of the signal heads and sensors (12 months)..... ☐
5. Physical appearance of the masts (12 months)..... ☐

C. OPINIONS

1. Damaged / missed / defected equipments and failures

2. Completed works.

TEKNOTEL Maintenance Team		CUSTOMER	
Date :		Date :	
Sign. :		Sign :	
Name :		Name :	