ATSC4 Traffic Signal Controller

ATSC4 Field Service Manual

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1.0	27/11/2011	[redacted]	Initial release derived from 400-FLM-001
1.1	30/04/2013	[redacted]	Added information on XDY and updated address details of ATC.
1.2	25/11/2013	[redacted]	Added section providing information on S and P Type cabinets and moved Appendices Section to Section 14.
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Acronyms

Acronym	Description
ATSC4	Traffic Signal Controller equipment compliant to the RTA of NSW (Australia) TSC/4 Specification.
BPM	Backplane Module
CAN	Controller Area Network
CBM	CPU Baseboard Module
CFM	Conflict Monitor Module
COTS	Commercial Off The Shelf
CPLD	Complex Programmable Logic Device
CPR	Cardio-Pulmonary Resuscitation
EIM	External Interface Module
ELV	Extra Low Voltage
EM	Extender Module
EMC	Electro-Magnetic Compatibility
ESD	Electro Static Discharge
FCM	Flash
FCOR	Flash Change Over Relay
FLU	Flasher Unit
HHT	Hand Held Terminal
HRS	Hardware Relevant Software
GSU	Gas Sensor Unit
ISP	In System Programmer
LIU	Line Isolation Unit
LPM	Logic Processor Module
LTP	Loop Termination Panel
MTU	Module Tester Unit
NEXTG	UMTS (3G) Mobile Phone Telephony by Telstra Australia
OPM	Signal Group Output Module
PROM	Programmable Read Only Memory (replaced by CARDBUS card in TSC/4)
PSM	Power Supply Module
SBC	Single Board Computer
SBM	Switch Board Module
SCATS	Sydney Coordinated Area Traffic System
SCM	Secondary Conflict Monitor
SELV	Safe Extra Low Voltage
SFM	Special Function Module
SIU	Site Identification Unit
SMPS	Switched Mode Power Supply
VDM	Vehicle Detector Module

Table 1 Document Acronyms

Compliance Symbols

This product is in the process of obtaining certification for the following regulatory compliance for the operation of the controller:

C-Tick No. – ATSC4 Traffic Signal Controller

17700

A-Tick No. – SCATS Modem Interface (LIU)

17700

Certificate of Suitability – **AS3100:2002 A1.**
Certificate Number: 8447

Measurements

ATC use and comply to all the SI units of measure for all time, weights and lengths described in this manual (i.e. Metric).

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Acknowledgement

Many of the designations used by manufacturers and sellers to distinguish their products are claimed as trademarks. Where those designations appear in this document and where ATC was aware of a trademark claim, the designations have been printed in caps or initial caps.

Safety Warnings

This document has been written to describe the design and operation of the ATSC4 Traffic Signal Controller in accordance with the NSW RMS TSC/4 Traffic Signal Controller Specification.

This document is to be used by qualified traffic signal service personnel and must have at least AS3000 Wiring Rules qualifications before attempting to service this module.

Safety Notice

Please note this equipment operates on Nominal Mains AC voltage. The metal enclosure therefore has dangerous voltages inside and must only be installed, operated or serviced by suitably qualified and authorised personnel.

Before applying power, verify that the correct safety precautions are taken (See the following warnings.). In addition, note the internal markings on the components within the controller that are described under “Safety Symbols”.

Warning Notice

Please note any actions taken as a result of information contained in this or other ATSC4 documentation may have serious consequences for the operation of a traffic intersection.

Service Instructions are for trained personnel only. To avoid dangerous electric shock, do not perform any service unless qualified to do so.

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and cardio-pulmonary resuscitation (CPR) is present.

Capacitors inside the Traffic Signal Controller may retain a charge even if the module or controller is disconnected from its source supply and can be a source of electric shock to service personnel.

This applies to modules that carry mains ac voltage and also for extra low voltage dc modules.

Safety Symbols

The product marked with this symbol indicates an item with dangerous voltages present and appropriate safety precautions must be taken.
Service personnel MUST be qualified and to at least the AS3000 Wiring Standard before interacting with the ATSC4 controller.

This symbol is intended to alert the user to the presence of a potential safety risk. Particular attention should be given to the accompanying notes.

This symbol is used to indicate that the device being handled is sensitive to electrostatic discharge and all care should be taken for the handler to be earthed or connected to an anti-static strap before touching the unit as otherwise the components could be damaged from it.

Electrostatic voltages can often be of the order of 2 – 10KV but of little current though sufficient to breach defence barriers inside the chip to damage it.

This symbol indicates that the equipment to which this label is attached contains voltages that can cause serious electrical shock to service personnel.

Proper work practices should be used by suitably qualified and licensed service personnel when working on equipment with this label.

This symbol is the Protected Earth symbol and is used to indicate that the terminal or link is connected to this earth circuit.

Table of Contents

1 Introduction

The ATSC4 Traffic Signal Controller is a state-of-the-art system that can handle up to 32 Signal Group Outputs. The ATSC4 is based on the AMD SC520 Microprocessor that is based on an industry standard PC104 hardware format.

The ATSC4 controller is designed to be ground or post mounted and controls traffic signals as well as pedestrian and other external indicator systems. It is designed to be modular and flexible in allowing the composition of modules to be flexible.

The traffic controller consists of 2 main components, the Logic Rack and the Housing subsystems.

The ATSC4 Housing has been designed to allow interoperability with other traffic signal controller manufacturers. All power, signal and cable connectors are designed to be located such that the ATSC4 Logic Rack can be substituted easily.

The ATSC4 Housing has three form factors, the standard full sized ground mounted cabinet, the S Type small ground mounted cabinet and the P Type post mounted cabinet. The document primarily is written for a description of the standard full sized cabinet and specific information for the S and P Type cabinet are covered in Section 13 of this document.

The ATSC4 controller is designed to be ground or post mounted and as such its internal layout reflects such a mounting system with the interface to all field terminals located on an Equipment Mounting Panel on the lower half of the housing and the Logic Rack at the top of the housing. The housing is a weatherproof design able to withstand sun insolation and rain conditions for continued operation in the field.

Drawing number PN0362 shows an overview diagram of the layout for a fully fitted full sized ground mounted Traffic Signal Controller and all signal lines and AC Mains supply cables are routed from the bottom opening in the housing.

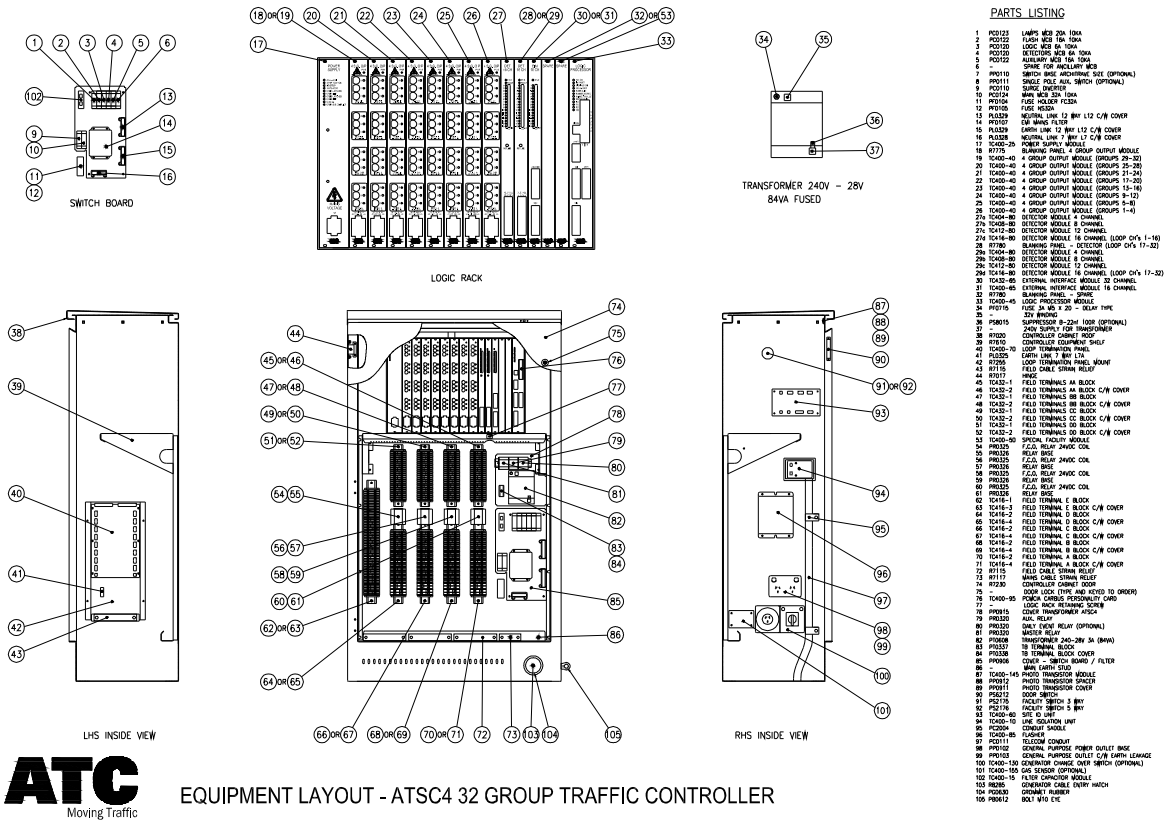


Figure 1 ATSC4 Controller Layout Drawing No. PN0362

Those signals are routed to terminals located on the Equipment Mounting Panel and appropriately labelled as shown in Figure 3 ATSC4 Wiring Diagram PN 0363.

All incoming signals and power cables go through signal conditioning and protection circuitry to provide the controller with the ability to cope with variations in input/output signal conditions such as lightning strikes, capacitive coupling of AC signals and other potentially disruptive signals.

The ATSC4 controller has been manufactured to the latest design standards for operational and environmental use and as such has been tested to be safe and predictable in the field.

The ATSC4 controller also uses the latest communications subsystem designed to allow field staff to access diagnostic information quickly and easily using simple tools to view internal data and messages as they occur without disrupting the operation of the controller.

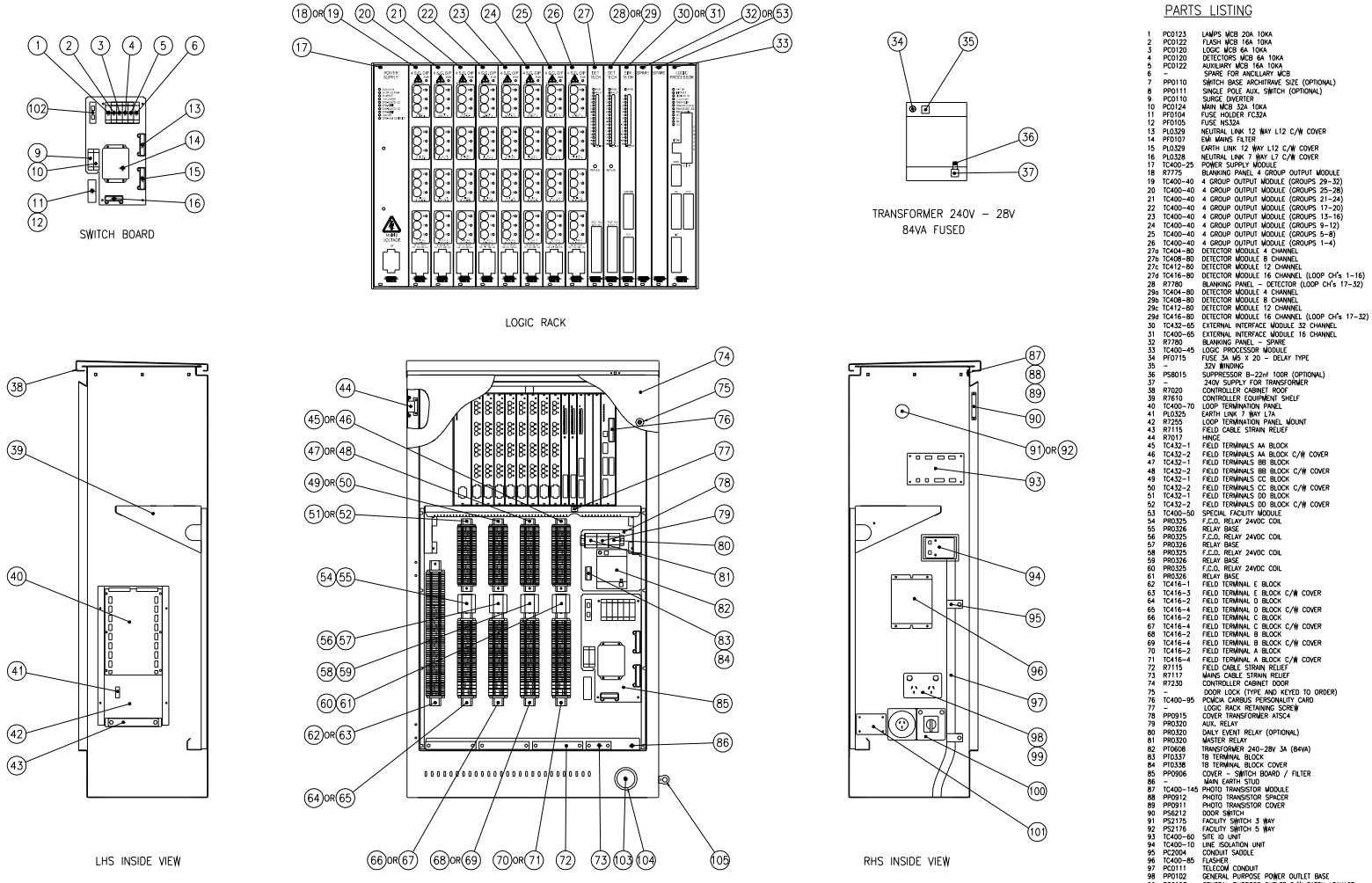


Figure 2 Complete ATSC4 Layout Drawing No PN0362

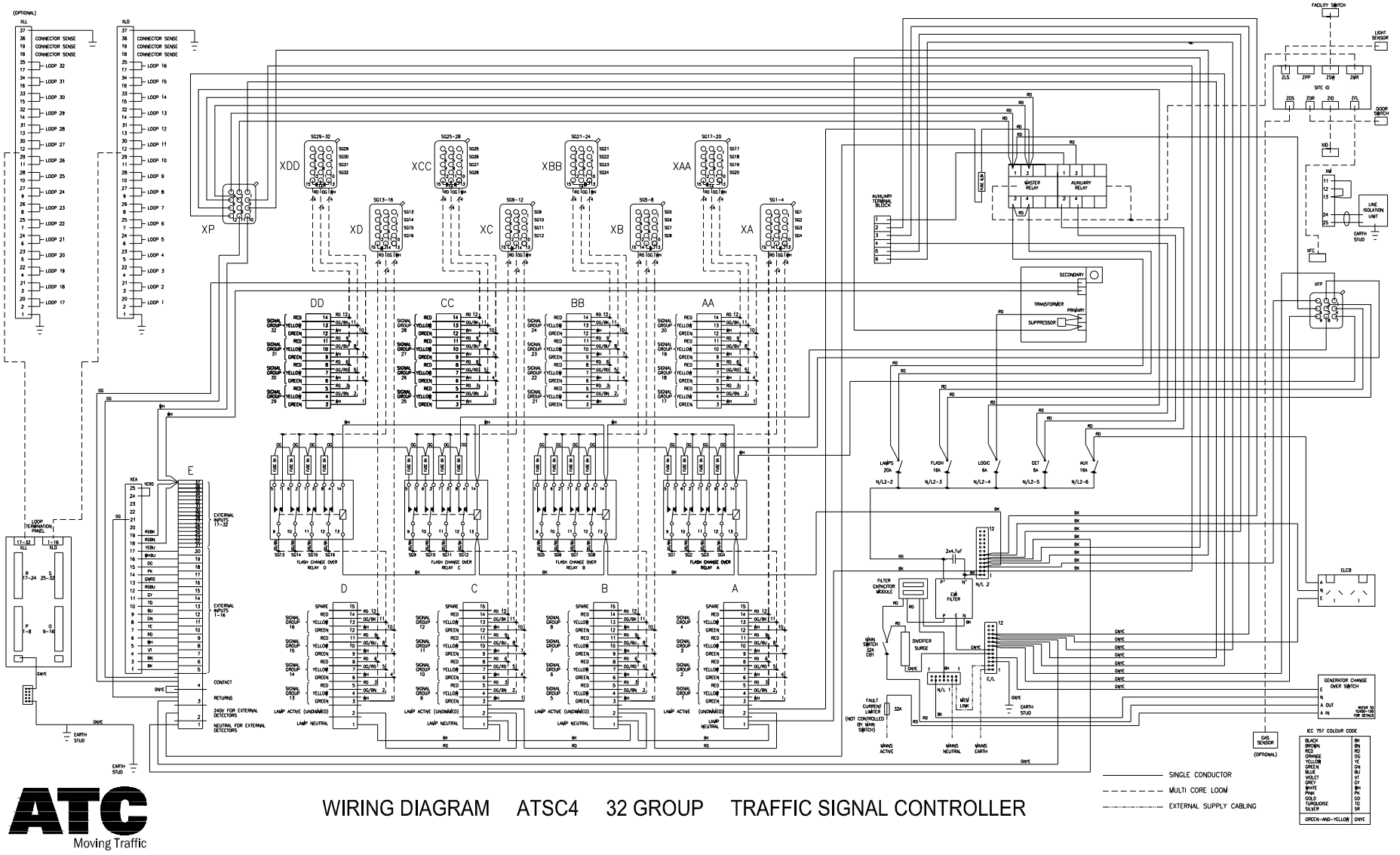


Figure 3 ATSC4 Wiring Diagram PN 0363

1.1 The Logic Rack

The Logic Rack of the ATSC4 Traffic Signal Controller is based on field proven technology that is designed for industrial applications, that is, the electronic hardware components used in the Logic Rack are all rated with an industrial operating temperature range of -40°C to +85°C.

The modularity of the design means that varying degrees of configuration can be achieved for a given intersection's design.

The ATSC4 design allows the user to assemble the most efficient configuration without waste on inputs or outputs. The Signal Group Output Modules are in groups of 4, thus an intersection can have 4, 8, 12, 16, up to 32 in groups of 4, External Inputs in 16 or 32 input configurations and Vehicle Detectors as 8 or 16 channel configurations.

The layout of the Logic Rack places all modules that route nominal mains on its PCB to the left side of the rack and all those using extra low voltage logic levels on the right side of middle (item 11 in the figure below) the rack.

A front view elevation is shown below in Figure 4 of various ATSC4 Logic Rack, 32 Signal Groups for the Ground Mount Cabinet, and 8 Signal Groups for the S-Type Cabinet and a 4 Group option for the P-Type Cabinet:

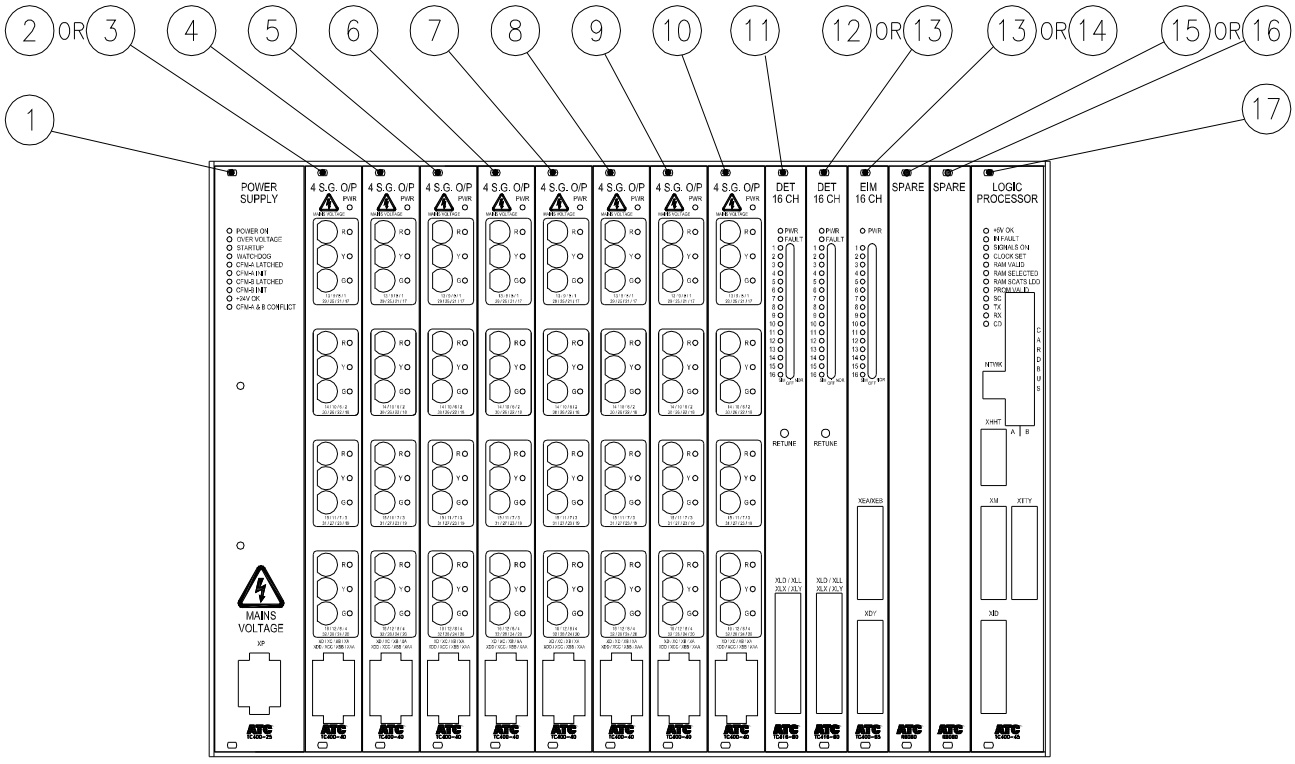


Figure 4a ATSC4 32 Group Logic Rack Front View

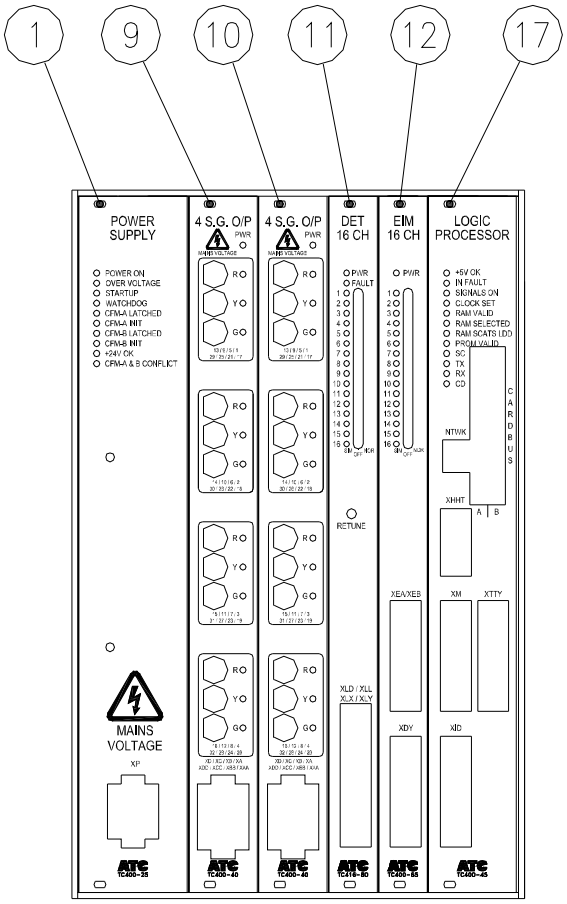


Figure 4b ATSC4 8 Group Logic Rack Front View

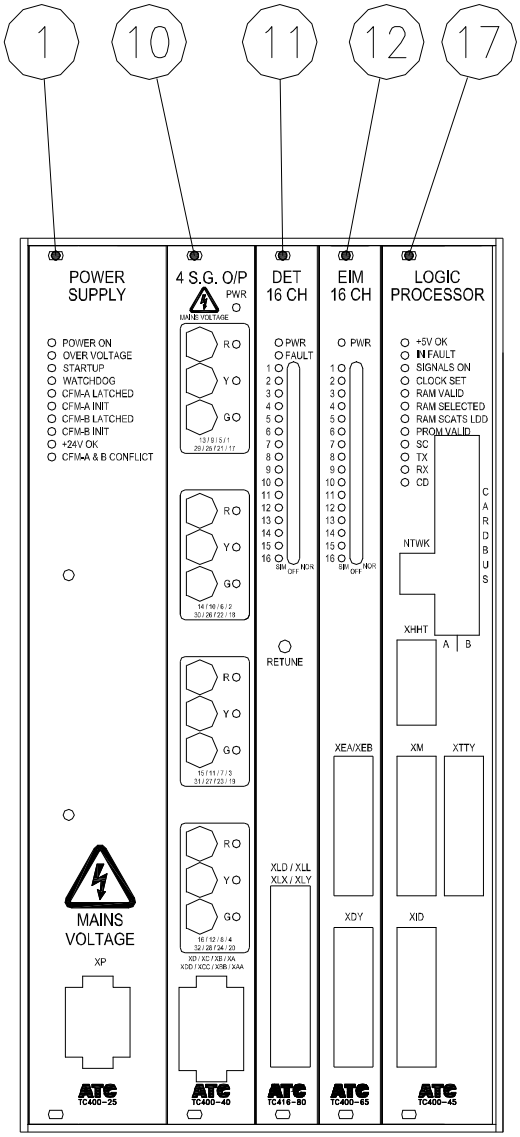


Figure 4c ATSC4 4 Group Logic Rack Front View

The backplane provides galvanic isolation between the two types of cards and the use of different backplane connectors for the modules means the field service technician has less likelihood of accidentally inserting a low voltage card into a mains ac module slot.

All status indicator LEDs are located on the front panels of all the modules. The interface to cables that connect inputs or outputs to the module are all located on the front of the module for easy access, and includes connector sensing circuitry to allow the onboard software to detect disconnected cables.

The ATSC4 includes a new Personality card that is based on the same Cardbus technology found in many laptops to store a given intersection's personality that is accessible from the front panel of the Logic Processor Module.

1.1.1 *Rack Configuration*

The ATSC4 Logic Rack can be fitted with up to 32 signal groups, however, a minimum configuration can be as follows:

Slot	Description	Acronym
1	Logic Processor Module	LPM
4	External Interface Module	EIM
6	Vehicle Detector Module	VDM
7	4 Group Signal Group Output Module	OPM
15	Power Supply Module	PSM
15	Conflict Monitor Module	CFM

Table 1 Minimum ATSC4 Module Configuration

Note that in all cases the Personality Card shall be fitted to the Logic Processor Module for correct operation and must be accompanied with a matching configured Site ID Module for the ATSC4 to function correctly.

Any slots not used will be provided with a blanking panel that is both aesthetically pleasing and more importantly prevent accidental contact with components on modules that may carry Nominal Mains AC voltage.

The layout of the modules is shown in the figure above and the corresponding numbered labels are detailed in Table 2 ATSC4 Electronic Rack Module Placement.

Note, where a slot may not be fitted with a module, then in its place a Blanking Panel is used to cover the slot, hence, the slot number shows 2 possible parts that may be fitted to it.

The ATSC4 Module acronyms as used throughout this document are detailed in Table 1 Document Acronyms.

Item	ATC Part Number	Slot No	Module Name
1	TC400-25	15	Power Supply Unit
2	TC400-240	14	Signal Group Output Module (29 – 32)
3	R8095	14	Blanking Panel
4	TC400-240	13	Signal Group Output Module (25 - 28)
5	TC400-240	12	Signal Group Output Module (21 - 24)
6	TC400-240	11	Signal Group Output Module (17 - 20)
7	TC400-240	10	Signal Group Output Module (13 - 16)
8	TC400-240	9	Signal Group Output Module (9 - 12)
9	TC400-240	8	Signal Group Output Module (5 - 8)
10	TC400-240	7	Signal Group Output Module (1 - 4)
11	TC416-80	6	16 Channel Loop Detector (1 - 16)
12	TC416-80	5	16 Channel Loop Detector (17 - 32)
13	R8080	5	Blanking Panel
14	TC400-65	4	External Input Module (1 – 16)
15	TC400-55	3	Special Facility Module
16	R8080	2	Blanking Panel
17	TC400-45	1	Logic Processor Module

Table 2 ATSC4 Electronic Rack Module Placement

The Logic Rack is designed to be easily replaced by the disconnection of all front mounted cables (requiring it to be powered down prior to physical removal) and replaced with a new ATSC4 Logic Rack or one of the other manufacturer's Logic Rack that are compliant to the TSC4 specification for interchangeability.

Note that the front mounted cables carry dangerous voltages and as such this operation MUST be done after powering down the controller and isolating the Mains AC voltage at the Logic Circuit Breaker.

1.1.1.1 Physical Characteristics

The Logic Rack is shipped from ATC separate from the housing to prevent physical stress or compression of the PCB and it's components during transportation.

The Logic Rack's physical characteristics are as follows:

Dimensions	4 Group	8 Group	16 Group	24 Group	32 Group
W * H * D (mm)	194 x 267 x 370	256 x 267 x 370	376 x 267 x 370	447 x 267 x 370	517 x 267 x 370
Weight (Kg)	8Kg	10Kg	12Kg	13.5Kg	15Kg

Table 3 ATSC4 Weight and Dimensions

Packing Method: Foam packing, anti-static wrapping and cardboard boxes are supplied by ATC.

Note: ATC always recommends shipping the Logic Rack in it's own packing box and materials for transportation separately from the ATSC4 Housing.

1.1.1.2 Removal and Installation

ATC recommends that this operation be done by appropriately trained service personnel as the Logic Rack weighs approximately 12 – 14 Kg when fully loaded.

A locking mechanism is used to hold the Logic Rack into place with respect to the shelf within the housing, this thumb screw must be undone before being able to pull forward the Logic Rack.

Handling Instructions: **Safe lifting practices must be employed.**

1.1.2 Power Subsystem

The Logic Rack is designed around a backplane that provides electrical and mechanical connections for all the modules in the ATSC4 rack.

As per the requirement of the TSC4 specification, there is no active components on the backplane, however, there are a number of low voltage signals as well as floating mains signals for inter-module use. Service personnel are strongly discouraged from touching the backplane while the controller is powered.

The ATSC4 controller modules are all supplied by the Power Supply Module located at the far left of the rack and converts a nominal mains ac input into a regulated dc voltage for use by various functions in the controller.

The Power Supply produces a bulk 24V dc output voltage used to power all the module electronics across the backplane.

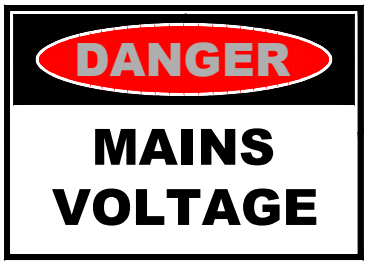
An isolated floating supply 8Vdc is created for the Output Module logic circuits.

These will be discussed in more detail in Sections 3 Logic Rack.

2 ATSC4 Housing

This section describes the sub sections incorporated into the controller housing.

2.1 Flasher Unit



The ATSC4 Flasher Unit is a new technology unit that is designed for highly rapid and secure response to a Fault condition in the field.

The Flasher Unit is a safety device which, in the absence of any other safe signal display, provides flashing yellow signals in preference to a blacked out display at an intersection. In the event of CPU activity ceasing for a given period the Flasher Unit shall provide a flashing yellow display.

2.1.1 Requirements for Flasher to Operate

A number of parameters must all be met for the Flasher Unit to start to operate:

1. The incoming mains supply voltage at XFP pins 4 and 5 must be greater than 156VAC.
2. The Lamp Active at XFP pin 6 must be less than 48VAC.
3. The Flasher Disable Toggle input at XFC pin 2 must not be toggling.
4. The Facility Switch Disable Flasher input XFC pin 6 must be high.
5. The Flasher Unit Fault Latch must not be set.

2.1.2 Reset Procedure

When a fault is detected by the flasher unit the output may be disabled to prevent damage to the Flasher Unit or External Devices.

If the 5mm RED LED is visible and solidly on within the Flasher housing the fault detection circuit has been activated and the Flasher will not operate.

The Flasher is reactivated by removing the power from the Flasher circuits by opening the Flasher Supply Circuit Breaker, waiting 5 Seconds and then Close the Circuit Breaker again.

2.1.3 Flasher Fuses

The Flasher is fitted with 2 fuses, one for each output, to prevent damage to the Flasher Unit or wiring.
These Fuses should only be replaced, with the same type and rating fuse.

2.1.4 *Flasher Change-Over Relay Drive*

For the flasher outputs to activate the lanterns, the Flasher Unit must activate the Flash Change-Over Relay.

The Flasher Unit will drive +24 Volts DC relative to Mains Neutral from XFP pin 7 to activate the Flash Change-over Relays.

NOTE: The Flash Change-Over Relays are **Turned On** for Flashing Yellow to be displayed.

2.1.5 *Flasher Unit Output Drive*

The Flasher Unit provides 2 separate outputs via XFP at Pins 2 and 8.

Each output will alternately supply 240Vac for a period of 500ms ON / 500ms OFF in standard configuration.

It is possible via a Jumper JP1 located on the PCB in the Flasher Unit for the two outputs to flash on at the same time.

2.1.6 *Mechanical*

The ATSC4 Flasher Unit requires an enclosure because of the presence of uninsulated mains on the PCB assembly. The Flasher Unit design for the ATSC4 has a PCB mounted to studs on an aluminium base plate. A mild steel cover is then fitted over the PCB and attached to the base plate. Although there is no requirement for the enclosure to be conductive, it is however, connected to earth to prevent accidental shock in case of mains voltage cable/connector comes into contact with the external cage.

Openings in the cover accommodate the panel mount XFP connector and the PCB mounted XFC connector. The cover has been designed to allow air flow, particularly along the long axis, but prevent access to uninsulated mains voltages within the enclosure. This also allows the status LED to be clearly visible without removing the cover.

The Flasher Unit is to be mounted to the Right Hand Side wall of the cabinet on the footprint shown in RTA drawing VM625-23.

2.1.7 *Status LEDs*

One LED is provided to indicate a Fault Condition Alert (red). The fault indicator LED is visible from a position in front of an open ATSC4 controller cabinet with the Flasher Unit fixed in place.

A second LED indicates that the Flasher is running correctly. It is a green surface mounted LED and visible as per the same as the Fault LED.

2.1.8 *Technical Description*

For a full technical description of the ATSC4 Flasher Unit please refer to the technical manual 400-TM-003.

2.2 Site Identification Unit

The Site Identification Unit is located on the internal Right Hand Side panel of the housing unit and not only contains the Site ID value read by the LPM, but also interconnects to a number of other sub-sections from within the housing to the LPM via the ZID connector to the Logic Processor Module XID connector.

Each function is briefly discussed in the subsections below.

2.2.1 Unique Identifier Number

The Site ID is designed to uniquely identify a given Traffic Signal Controller amongst all the traffic controllers in an authority's network. It also is used by the ATSC4 Software in the CPU to ensure that the Site ID value matches that stored in the Cardbus Personality card.

The CPU reads the Site ID value via the XID connector at start-up and if the value from the Site ID Unit does not match that in the Personality Card an exception is raised by the CPU to the SCATS master if connected and stops the start-up process until this fault is corrected and powered up again.

The Site ID Unit is connected to the XID connector on the front panel of the Logic Processor Module via cable TC400-101 and connector ZID on the unit itself. Details of this cable connection can be found in Section 8.4 Cable Connections – Site ID Unit of this manual.

The unit contains no active components and can be removed in situ only when the Traffic Controller is powered down.

To test the Site ID value being reported to the CPU, follow the procedure described below:

1. Check the ATSC4 controller is powered down.
2. Power on the ATSC4 controller.
3. Connect a laptop or HHT to the XHHT connector (serial port) of the Logic Processor.
4. Navigate to the page that displays the Site ID value and revision.
5. Verify that this value and revision matches that on the Personality Card.
6. Verify that if the 2 values match, the ATSC4 controller does in fact start up correctly after 10 seconds from being powered ON.

The ATC Site ID Unit Part Number is TC400-60.

2.2.2 Master Relay / Auxiliary Relay

The interconnecting wiring from the LPM to the coil and status contact for both the Master Relay and Auxiliary Relay are connected via the ZMR connector of the Site ID Unit.

2.2.2.1 Master Relay

The Master Relay provides the supply for Lamp Active to the Logic Module XP connector. The Master Relay supplies an undimmed lamp active to terminal 'A2' via a M5 x 20 fuse and Lamp Active to pin 6 of the 'XFP' connector of the Flasher Unit.

The Master Relay is under control of both the CPU and the Conflict Monitor systems and in the event of a conflict or a mode change in the ATSC4 controller software, either system switches the Master Relay OFF, thus removing Lamp Supply to the Signal Group Outputs.

2.2.2.2 Auxiliary Relay

The Auxiliary Relay provides detector supply to Terminal ‘E2’ from the Detector MCB and supply from the auxiliary MCB to Terminal ‘TB1’.

The Auxiliary Relay can be controlled in parallel with the Master Relay, via independent software control or it can be configured to operate whenever the Logic Supply is ON.

This configuration selection is done on the Logic Processor Module HRS.

The Facility Switch can override control of both the Master Relay and Auxiliary Relays into the OFF state.

2.2.2.3 Procedure to Check Master / Auxiliary Relays

Use a Multimeter set to Volts DC range to measure the presence of 24Vdc across the relay coil terminals at the time of relay operation. When either relay is in the ‘OFF’ state, both sides of the coil should read +12Vdc relative to zero (0) volts.

2.2.3 Flasher

The Site ID Unit connects to the Flasher Unit via the ZFL connector that carries the control signals that provide a pulse every 0.5Hz to the Flasher as a heartbeat to indicate that the Logic Processor is inhibiting the Flasher from flashing the Signal Group Yellows.

The connector on the Flasher Unit is XFC. The ‘XFC’ cable ATC Part Number is TC400-105.

The Flasher Unit ATC Part Number is: TC400-84 or TC400-85.

2.2.4 Light Sensor

The ATSC4 controller Light Sensor input is connected to the Site ID Unit via a cable to connector ZLS on the Site ID Unit.

This input is read by the LPM Baseboard PIC microcontroller to determine when the ambient light has decreased from day to night and vice versa. This input is used to dim or return to normal brightness the Signal Outputs at specific times of day.

The Light Sensor itself is located on the front face above the door of the housing and should be kept clear of dirt or debris at all times for correct operation. To clean the light sensor itself use a dry cloth and wipe until the dirt or other matter has been cleared and the light sensor lens is clean.

The Light Sensor can be tested by shining a light source of known intensity located directly in front of it and seeing an appropriate light level on the ATC User Interface (i.e. laptop or HHT).

To test if the light sensor is working correctly, follow these steps:

1. Open the door.
2. Connect the laptop or HHT to the Logic Processor XHHT Connector.
3. Navigate to the page that displays the Light Sensor reading.
4. Apply a known light source to the light sensor by holding it directly in front of sensor.
5. Read the value reported on the Light Sensor Screen page.
6. Check the reading is appropriate for the applied light source.

The Light Sensor is of a Photo Transistor type and its ATC Part Number is TC400-145.

The Light Sensor interconnecting cable has an ATC Part Number of TC400-148.

2.2.5 *Door Switch*

The ATSC4 contains a door switch that detects when the ATSC4 controller door has been opened.

The door switch is a reed switch that is located on the inside right panel lip next to the door and the switch interfaces to the Site ID Unit connector ZDR via a cable.

The door switch is treated as a digital input by the CPU and is fed a dc voltage via the Site ID Unit, and the presence of this voltage is monitored by the CPU when the door is closed.

When the door is opened, the circuit becomes an open circuit because the magnet located in the door is no longer near enough to pull the contact down and close the circuit.

To test if the reed switch is working correctly, follow these steps:

1. Make sure door is fully open.
2. Connect the laptop or HHT to the Logic Processor XHHT Connector.
3. Navigate to the page that displays the Message Log.
4. Observe the Message Log.
5. Using a dummy door switch magnet unit, locate the magnet next to the reed switch and observe the door is reported as CLOSED.
6. Now remove the dummy door magnet and observe the door is reported as OPEN.
7. If both actions are reported as above the door switch is operating correctly.

The Door Switch ATC Part Number is: PS2120.

The Door Switch interconnecting cable has an ATC Part Number of TC400-103.

2.2.6 *Facility Switch*

The Facility Switch allows service personnel or emergency personnel to manually switch the traffic controller from normal signal switching operation into one of 3 or 5 modes (depending on locality of traffic authority).

For operation in Australia, a 3 position Facility Switch is fitted to the ATSC4 with the following positions in clockwise order:

1. **OFF**
2. **FLASH**
3. **ON**

The Facility Switch output consists of a Gray◊ code digital value read by the Logic Processor Module to determine the position of the switch. The Facility Switch is connected to the Site ID Unit via a cable connected to connector ZSW.

The cable Part Number is TC400-100.

The function of each switch position is summarised here:

Position	***Function***
OFF	Removes Low Voltage from all external circuits including: 1. external detector equipment 2. audio-tactile devices 3. external auxiliary circuits Removes Mains ac voltage from the following circuits: 4. Flashing Active Outputs from the Flasher Unit. 5. Drive supply to the Auxiliary Relay. Note: Low Voltage supply for audio-tactile devices is sourced from the Lamp Active supply at the A, B, C or D terminal block assemblies (unregulated and undimmed).
FLASH	Places the signal outputs into Flash Mode. This mode energises the Flash Change-Over Relays and the Flasher Output is applied to the Yellow aspect of the designated signal group outputs. This mode removes Lamp Active supply from the signal switching equipment but does not remove the Low Voltage supply from External Detector equipment or External Auxiliary Supply equipment.
ON	Allows the controller logic to operate the signal outputs normally and provides 240V ac supply to the lamps. This mode also enables low voltage supply to the external detector equipment, audio tactile devices and external auxiliary equipment.
(Optional 5 position Facility Switch)	**Currently available for Overseas Markets**
Manual	As per 'ON' position, but rests in Current Phase.
Step	As per 'ON' position, but steps forward to Next Phase.

Table 4 Three and Five Position Facility Switch Functions

The Facility Switch ATC Part Numbers are as listed below:

3 Position : PS2175
5 position : PS2176

◊ *Gray code is a coding method where each digital value differs from the next by only one bit for both higher/lower values.*

2.2.6.1 Rating

The Facility Switch contacts are rated as Extra Low Voltage for use with +12V dc and current rating on the contacts for 10mA.

2.2.6.2 Switch Gray Codes

The 3 and 5 way Facility Switches have Gray codes for each position as read by the Logic Processor Module as shown in the tables below that can be used for detecting faulty switches.

As a user moves the facility switch, the digital value at the Site ID Module shall change by only 1 bit at a time, so starting from the OFF position, read 1 and 0, moving the switch to FLASH the user should then see 1 and 1, moving to ON the user should see 0 and 1 for bits 1 and 2 respectively.

Switch Position	Gray Code	
	Bit 1	Bit 2
OFF	1	0
FLASH	1	1
ON	0	1

Table 5 Three (3) Position Facility Switch Gray Code Output

Switch Position	Gray Code		
	Bit 0	Bit 1	Bit 2
OFF	1	0	0
FLASH	1	1	0
ON	0	1	0
MANUAL	0	1	1
STEP	0	0	1

Table 6 Five (5) Position Facility Switch Gray Code Output

2.2.7 Police Panel Interface

The Police Panel Interface is an optionally fitted unit and is connected to the Site ID Unit via connector ZPP on the Site ID Unit.

2.2.8 Gas Sensor Interface

The Gas Sensor is an optionally fitted unit and the cable for the 12V dc supply and status signals interconnects the unit via the ZGS connector on the Site ID Unit.

The Gas Sensor ATC Part Number is: TC400-155.

2.2.9 Technical Description

For a full technical description of the ATSC4 Site ID Unit please refer to the technical manual 400-TM-004.

2.3 Equipment Mounting Panel Assembly

The Equipment Mounting Panel Assembly is a mild steel sheet firmly secured to the housing via 8 M8 nuts and 3 M6 bolts, and these should be checked to ensure none are loose at any time as the Equipment Mounting Panel has a number of circuits that carry mains ac voltages.

ATC recommend that any work undertaken inside the ATSC4 controller be performed by suitably qualified and competent personnel or at least to AS3000 Wiring Rules and that it should be performed in the presence of another suitably qualified person that can render emergency cardiopulmonary resuscitation (CPR) in case of electric shock from circuits contained within the ATSC4 traffic signal controller.

2.3.1 Mains AC Subsystem

The ATSC4 traffic signal controller is designed to be connected to the Mains AC supply as provided by the relevant energy authority.

The mains ac shall be provided via an underground cable and be connected to the AC Switchboard/Filter circuit located at the bottom right hand side of the Equipment Mounting Panel as can be seen in ATC drawing PN0362.

2.3.1.1 Main Switch

The rating of the incoming cable shall not be less than those specified by the relevant authority and these shall be connected to the following terminal strips:

Active (Red)	32A Fault Current Limiter Terminal
Neutral (Black)	Neutral Link Block 1 (N/L 1) Terminal 7.
Earth (Green/Yellow)	Earth Link Block 1 (E/L 1) Terminal 1.

The output of the Fault Current Limiter is connected to the Main Switch CB1 that is rated to 32A.

This is the main isolation switch for the ATSC4 controller that provides mains ac supply to all the sub-system MCB via the Mains Filter.

The output of the Main Switch is then routed in parallel to the Surge Diverter and the EMI filter.

2.3.1.2 Surge Diverter

In the event of a lightning strike or a surge in voltage/current on the AC Mains line, the surge diverter should clamp that voltage rise to prevent damage to the electrical/electronic subsystems and divert it to ground.

The ATC Part Number is: PC0110.

2.3.1.2.1 Procedure to Check Surge Diverter

The surge protector is fitted with an indicator window that displays if the surge diverter has been stressed or failed, at which time it should be replaced by a plug-in replacement module.

Note once the diverter has been stressed it will not protect against further surges that may occur after that initial event.

2.3.1.3 EMI Filter

The EMI Filter is a SAMIL NFM-230 or a STRONG STM6-102-301D that attenuates any inappropriate signals and prevents any possible interference generated by the ATSC4 from being fed back into the mains supply.

The EMI Filter is rated to operate over the following ranges:

Operating Voltage	0 – 280v ac

Table 7 ATSC4 EMI Filter Ratings

The ATC Part Number is: PF0107.

2.3.1.3.1 Procedure to Check EMI Filter

Service personnel can verify that the filter is operating correctly by observing the load side (filtered) voltage waveform and that it is the same as that at the input side.

A simple verification is to use a multi-meter and observe the AC voltage is the same amplitude or for a more in depth view an oscilloscope device can be used to view the waveform and see what if any interference is being filtered.

2.3.1.4 Filter Capacitor Module

The Filter Capacitor Module is connected as a parallel connection to the Load side of the EMI filter and the Line side of the Sub-Switchboard Switch Circuit Breakers.

The purpose of the FCM is to eliminate any transient spikes that arise from the Logic Module during the dimming stage of operation.

The ATC part Number is: TC400-15.

2.3.1.5 Mains AC Sub-Switchboard

The output of the EMI filter is connected to the Main AC Switchboard that contains 5 Switch Circuit Breakers (CB) each of which feeds a separate circuit within the housing:

CB	Circuit	Rating (A)	Neutral Link Terminal
2	Lamp Supply	20	N/L2 - 2
3	Flasher Supply	16	N/L2 - 3
4	Logic Rack	6	N/L2 – 4
5	Vehicle Detector	6	N/L2 – 5
6	Auxiliary Supply	16	N/L2 - 6

Table 8 Mains AC Sub Switchboard Circuits

Each of these Circuits can be isolated individually by individually switching OFF or ON as required.

Should there be a fault in any one of these circuits then the Circuit Breaker will switch from ON to OFF to prevent damage from short circuits or other malfunctions.

Service Personnel should use these in order to assist in isolating any faults within the ATSC4 controller circuits.

The Lamp Supply CB active output is connected to the Master Relay terminals 2 and 4 respectively which is controlled by the Logic Processor Module and/or Conflict Monitor via control signals connected via the ZMR connector on the Site ID Unit.

2.3.1.5.1 Procedure to Check Sub-Switchboard

This process involves switching the circuit breakers individually and observing with a multimeter between the load side and neutral that it's correctly switching mains through it.

The voltage at all times should be Nominal Mains ac. If there is a short circuit on the load side of the Circuit Breaker then it will trip until the short circuit is removed.

2.3.2 ELV Transformer Subsystem

The Extra Low Voltage transformer is located in the middle right hand side of the Equipment Mounting Panel and provides 28V ac up to 3A on the load side and is fed nominal mains ac at the input side from the Logic MCB.

This source of ELV is used to provide power to the External Inputs to the ATSC4 logic rack via terminal E37 of the 'E' Terminal Strip.

2.3.2.1.1 Procedure to Check ELV Transformer

In order to test the ELV transformer a general purpose multi-meter is sufficient to test the transformer, with the ATSC4 controller powered up and all the MCBs closed, observe the presence of 240V ac at the Primary terminals and approximately 28V ac at the Secondary terminals of the ELV transformer.

2.3.3 Field Termination Blocks A – D

Terminal Blocks A – D comprise Terminals for four signal groups, an undimmed Lamp Active, Field Cable Neutral and one spare Terminal.

Termination blocks A – D each have a 4 pole relay fitted for control of the Yellow Signal Group circuits to be supplied from the Signal Group Output Modules normally or the Flasher Unit outputs in certain specified conditions. The Flasher Unit output is fed via up to four M5 x 20 Fuses rated at 5 Amps each and fitted in fuse carriers adjacent to the Flash Change-Over Relays. In a P Type cabinet the Field Termination Block 'B' does not have a Flash Change-Over Relay.

Refer to Drawing TC416-8 located in Tab Section 10 of this Field Manual.

2.3.4 Flash Change-Over Relay Subsystems

The Flash Change-Over Relays consists of 4 N/O - N/C contacts. The coil voltage is 24Vdc and this voltage is supplied by the Flasher Unit and referenced to Mains Neutral.

Each Flash Change-Over Relay is fitted with an Indicator LED to shown when that relay is activated.

2.3.5 Field Termination Block E Subsystem

The 'E' Terminal block is for the External contactor closure Inputs, Detector Common, Auxiliary Relay controlled detector supply (E2), External Detector Neutral (E1) and termination of the 28Vac Supply (E37).

Refer to Drawing TC416-7 located in Tab Section 10 of this Field Manual.

2.3.6 *Field Termination Blocks AA – DD Subsystems*

Termination blocks AA-DD comprise terminals for four (4) Signal Groups each and are used for expanding a controller above 16 Signal Group Outputs.

Termination blocks AA – DD do not have Flash Change-Over Relays (FCOR) fitted or any additional terminals blocks supplied.

Refer to Drawing TC432-2 located in Tab Section 10 of this Field Manual.

2.4 Loop Termination Panel Assembly

The Loop Termination Assembly comprises four sections P, Q, R and S. Each section handles 8 loop detectors.

Sections P and Q feed the connector labelled Loops 1 – 16 (XLD).

Sections R and S feed the connector labelled Loops 17 – 32 (XLL).

Each Loop Termination pair has 1 Dual Gas Arrestor, with the centre pin connected to Chassis Ground.

Note: *Special care should be taken to ensure that the unshielded part of the loop feeder is as short as possible, the Loop Feeder conductors are twisted and the Loop Feeder drain wire is connected to the link labelled "LOOP SCREENS".*

The ATC Part Numbers are either: TC400-70, TC400-74 or TC400-78.

2.4.1 *Technical Description*

For a full technical description of the ATSC4 Loop Termination Panel please refer to the technical manual 400-TM-013.

2.5 Line Isolation Unit Assembly

The Line Isolation Unit Assembly consists of a housing and a line isolation/protection circuit that is mounted within the LIU housing and is mounted on the right hand side of the controller, approximately half way up.

The telecommunications line is routed via conduit directly to the LIU housing from the bottom plinth. The output of the module is then connected to the Logic Processor Module via the XM connector or to an external modem if required.

The XM connector on the Logic Processor Module can be connected to either a 300 baud modem, a high speed (56kBaud) internal modem or direct to a serial port (RS-232).

The ATC Part Number is: TC400-10.

2.5.1 Housing

The LIU housing is mounted to the cabinet via four (4) M4 nuts. The LIU PCB sub-assembly is mounted in the housing by three (3) M3 SS PH screws. This allows for the replacement of the LIU PCB sub-assembly without removal of its housing.

2.5.2 Line Isolation Unit

The Line Isolation Unit is a combination of an ACA approved Line Isolation Transformer suitable for connection to a telecommunications circuit and a surge protection circuit that will clamp and divert any waveform deemed damaging to the load side (ie the modem on the Logic Processor Module) to earth.

2.5.2.1 Procedure to Check Line Isolation Unit

The Line Isolation Unit can be checked with an oscilloscope or other similar instrument to observe the signal being modulated by the modem.

1. Check the modulation waveform at connector XM of the modem to see the quality of the signal.
2. Remove the cover of the Line Isolation Unit by unscrewing the holding screws.
3. Check the waveform at the Line Isolation Transformer and observe the Surge Protection Circuit has not introduced any distortion or blocking the signal.
4. Check the waveform on the line side of the transformer and if this is similar to that at the modem terminals the circuit is operating correctly.
5. If not, check the cable between the XM connector on the Logic Module and the Line Isolation Unit by testing the continuity of the individual wires.
6. If the cable tested in the previous step is OK, replace the Line Isolation Unit with another unit and go through steps 1 to 4 again.

2.5.3 Technical Description

For a full technical description of the ATSC4 Line Isolation Unit please refer to the technical manual 400-TM-014.

2.6 Gas Sensor Unit (Optional)

The Gas Sensor Unit, if fitted is located on the lower right hand side of the housing.

Note, particular caution shall be exercised when servicing this unit as it is very sensitive to sprays or other silicon based compounds as the vapours released by such substances reduce the sensitivity of the Gas Sensor itself.

Service personnel shall ensure that there are no naked flames or lighting devices used (matches, cigarette lighters etc) in or near the controller where such units are fitted.

ATC recommends that appropriate safety work procedures are followed.

The sensor devices as specified in the TSC/4 specification is a TGS 813C Methane Type gas sensor that is particularly sensitive to Methane, Propane and Butane gases generally from underground pits that contain natural gas piping or near mining sites.

The Gas Sensor is fitted with 2 status LEDs, a GREEN one to indicate dc power to the unit is available and one RED to indicate that the sensor has detected gas.

If the Gas Sensor LED is lit, then this will also cause a digital input to be asserted via the ZGS connector on the Site ID Unit to the Logic Processor Module and an event is recorded in the Message Log and sent to the SCATS Master, if connected.

The Gas Sensor cable assembly Part Number is: TC400-158.

The Gas Sensor ATC Part Number is: TC400-155.

2.6.1 Procedure to Check Gas Sensor Unit

The Gas Sensor Unit must ONLY be tested in a workshop.

Please refer to the unit's Technical Manual document for exact procedures to be followed to verify correct operation.

2.6.2 Technical Description

For a full technical description of the ATSC4 Gas Sensor Unit please refer to the technical manual 400-TM-018.

2.7 Generator Change-Over Switch

The Generator Change-Over Switch allows the connection to the ATSC4 traffic signal controller of an appropriate generator set in times of mains outage.

The Generator Change-Over Switch is available in two current ratings, a 20A version and a 32A version.

Access for the supply lead from the generator is via a mouse trap style hatch located on the lower front right hand side of the cabinet. This access hatch is covered by the door when closed, however it still allows for the supply lead to be fitted.

The Generator Change-Over Switch is not available in the P-Type Housing.

2.7.1 Wiring Detail

The Generator Change-Over Switch Assembly interconnects into the front end part of the switch board wiring. It consists of two mains supply wires, one into the assembly and the other the switched mains supply. The other wires are a neutral wire and an earth wire.

The assembled is wired into the housing by firstly removing the wire link between the Fault Current Limiter and the Main Switch which is a 32A MCB. The main supply-in wire is connected to the load side of the Fault Current Limiter and the switched mains supply-out wire connected to the line side of the Main Switch.

The neutral wire is connected to N/L1 and the earth wire is connected to E/L1.

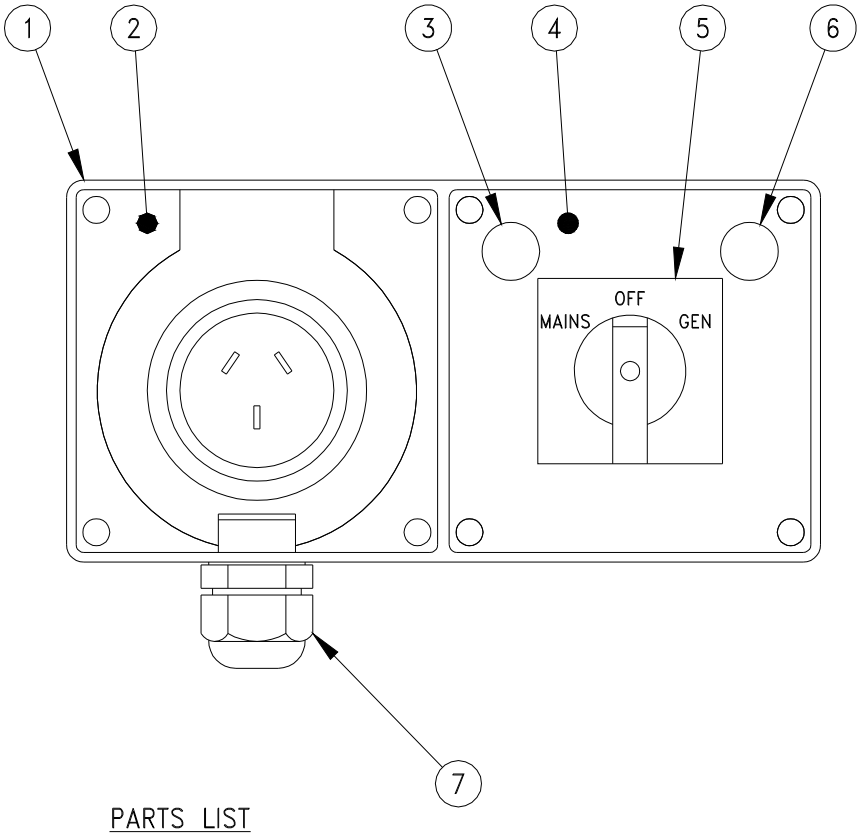
The part numbers for these assemblies are as follows:

- 20A version TC400-130
- 32A version TC400-132

Refer to Wiring Diagram PN0436 located in Tab Section 9 of this Field Manual.

2.7.2 *Generator Change-Over Switch Assembly*

The Generator Change-Over Switch comprise of a three position switch and an IP56 3 Pin Appliance Inlet. There are two indicator LEDS. Figure 5 below shows the layout.



PARTS LIST

1.	PP0120	BOX INDUSTRIAL 2 GAND
2.	PP0122	SOCKET APPL INLET 10A 3 PIN IP55
3.	PL0416	LED 10mm GREEN INDICATOR
4.	PP0126	BOX JUNCTION PVCIP66 1 GANG
5.	PS2156	SWITCH GENERATOR CHANGE OVER
6.	PL0415	LED 10mm YELLOW INDICATOR
7.	PG0660	GLAND NYLON 8–13mm GN20

Figure 5 ATSC4 Generator Change-Over Switch Layout

2.7.3 *LED Functions*

The GREEN LED indicates the presence of Nominal Mains supply.

The YELLOW Led indicates the presence of Generator Mains Supply.

2.8 Pedestrian Wait and Daily Event Outputs

The Pedestrian Wait Outputs enable the ATSC4 traffic signal controller to drive LED Call Record Indicators on Pedestrian Push Buttons when installed at an intersection.

The interconnection of these outputs is via the XDY loom from the XDY Connector of the EIM Module. The XDY connector also has the Daily Event Output available for use.

The XDY Field Termination Module comprises two versions, the TC432-5 and TC432-6 Modules. The module is typically mounted in the 'XDD' location of the Equipment Panel.

2.8.1 TC432-5

The TC432-5 module consists of a 24Vdc coiled relay with indicator, fuse (315mA) and field wiring terminal per output mounted on a Din Rail mounting system. Typically this version is configured in a 4 output configuration for 4, 8 and 12 group controllers and 6 outputs for 16, 24 and 32 group controllers. Additional parts can be added to increase outputs.

2.8.2 TC432-6

The TC432-6 module consists of a PCB fitted to a DIN Rail mounting enclosure. The PCB has an individual circuit for each output consisting of a 24Vdc coiled SMD relay, an indicator LED, PTC for over current protection and field wiring termination. This version is supplied in a 4 output configuration for 4 group controllers and an 8 output configuration for 8, 12, 16, 24 and 32 group controllers. A figure of this module is provided on the next page.

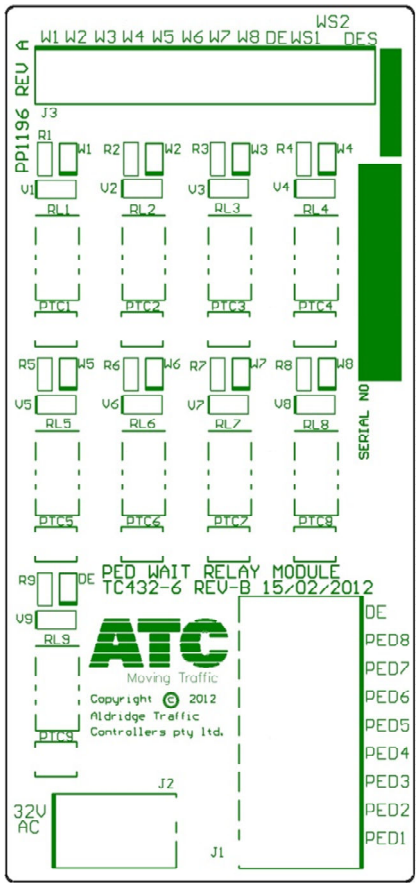


Figure 6 ATSC4 Ped Wait and Daily Event Interface Module

2.8.3 *Wiring Detail of XDY Loom*

The wiring colours and pin allocation of the XDY loom is listed in the table below.

Function	XDY Pin	TC432-5	TC432-6	Wire Colour
P_Wait 1	14	RLY1-0V	W1	Black
P_Wait 2	15	RLY2-0V	W2	Brown
P_Wait 3	16	RLY3-0V	W3	Violet
P_Wait 4	17	RLY4-0V	W4	White
P_Wait 5	18	RLY5-0V	W5	Red
P_Wait 6	19	RLY6-0V	W6	Yellow
P_Wait 7	20	RLY7-0V	W7	Green
P_Wait 8	21	RLY8-0V	W8	Blue
P_Wait 24Vdc	22	RLY1-24V	WS1	Red/Black
P_Wait 24Vdc	23	RLYx-24V	WS2	Red/Brown
		x is the last fitted relay		
Daily Event	9		DE	Yellow/Red
D.E. 24Vdc	11		DES	White/Red

Table 9 XDY Wiring Details

3 Logic Rack

3.1 Backplane

The ATSC4 backplane has no user serviceable components and is a passive backplane that provides mechanical and electrical connectivity for the individual ATSC4 Modules.

The backplane is a PCB mounted within a Logic Rack Assembly that locks on to a shelf for normal operation.

Service Personnel must ensure that the backplane and Logic Rack Assembly it is mounted in are securely locked to the shelf of the ATSC4 housing.

The ATC Part Number for a 4 Group Backplane is: TC404-91.
The ATC Part Number for an 8 Group Backplane is: TC408-91.
The ATC Part Number for a 16 Group Backplane is: TC416-91.
The ATC Part Number for a 24 Group Backplane is: TC424-91.
The ATC Part Number for a 32 Group Backplane is: TC432-91.

For a detailed description of the backplane please refer to the Backplane Technical Manual 400-TM-005.

3.2 Logic Processor Module (LPM)

The Logic Processor Module is a 32 bit CPU located on a PC104 format PCB that sits atop the Logic Processor Baseboard. It is the Logic Processor Baseboard that is plugged into the ATSC4 backplane and can only be located in slot 1 which is the rightmost slot of the Logic Rack Assembly.

The Logic Processor Module has a total of 12 front mounted LEDS. The “+5V OK LED” will come on immediately power is applied if the Power Supply Module is running correctly.

During the start-up sequence the LEDs perform a different function than described on the front panel artwork and the description of this functionality can be found in the Technical Manual 400-TM-025. This can be found in Tab Section 8 of this Field Manual.

The Logic Processor Module has 5 connectors and 2 PCMCIA Cardbus Card slots.

The connectors are NTWK which is a TCP/IP connection, XHHT which is for the Hand Held Terminal or laptop to communicate and interrogate the controller, XM which is the modem connection, XTTY which is a serial comms terminal port and XID which interconnects to the Site ID Unit via the ZID connector to interface to all the cabinet sub-systems.

The PCMCIA Cardbus Card slots are labelled ‘A’ and ‘B’. The ‘A’ slot is for the intersection personality and the ‘B’ slot is spare and can be used for storing the controller logs to a card. The ‘A’ slot is also used during an initialisation period to do HRS / TRAFF updating of the main processor board.

For a detailed description of the Logic Processor Module please refer to the Logic Processor Module Technical Manual 400-TM-007.

3.3 External Interface Module (EIM)

The External Interface Module is the module that interfaces to push button inputs, video detection inputs and other contact closure inputs as well as supplying control of relays for features like Ped Wait indicators or controlling Give Way To Ped or No Right Turn signs.

This module can be configured to monitor 8 or 16 external inputs via the front connector XEA and drive up to 8 Wait Output or 1 Daily Event Output via connector XDY.

If a second External Interface Module is installed in a Logic Module then the connector allocation is XEB for the inputs and the outputs are not functional.

If configured as an 8 input module, there is an onboard link that is set at the factory between pins 2 and 3, otherwise, the module software defaults the unit to a 16 input configuration.

The module has a total of 9 or 17 front mounted LEDs of which only 1 will come on almost instantly after powering up and that is the Green LED labelled “PWR” at the top of the front panel, as this is turned ON by the local microcontroller very soon after start-up or release from RESET.

Once the module is running and the LED labelled “OK” is ON solidly, the microcontroller commences sampling the external inputs and checking that it can communicate with the CPU.

If the EIM microcontroller does not detect a valid message from the CPU for 3 seconds or more, it will send messages to the CPU via the internal Canbus and commence flashing the “OK” LED at the front of the module until this comms is restored.

Though it is not recommended to start the controller with any of the field cables out, the EIM will commence operating and running even if XEA or XDY are not plugged in. The module will notify the CPU that its external interface cable(s) are not plugged in. Such messages to the CPU will cease to be sent from the EIM once the appropriate connectors are plugged into the module.

3.3.1 External Input Supply Voltage

In order for the module to monitor external inputs in the field such as pedestrian push buttons, each input is connected to an ELV supply voltage that goes out to the field equipment (i.e. pushbuttons) and returns to the module via the XEA connector.

When the user depresses the pushbutton, the input is connected to zero volts (0V) and this is how the input is detected as having been actuated.

The ELV supply voltage is 28V ac which is sourced from the ELV transformer mounted on the Equipment Mounting Panel of the ATSC4 controller and this should be checked to see if the transformer’s secondary output is approximately that voltage.

The EIM does not rely on the amplitude of the voltage signal, hence, the EIM will continue to detect inputs right down to 18v ac if the voltage output of the ELV transformer should drop down to those levels.

Note: If there is an absence of the ELV voltage, there can be no input detections by this module. This locks ALL inputs ON and turns ALL input indicator LEDs ‘ON’.

3.3.2 *External Outputs*

As mentioned previously, the EIM can drive up to 8 Pedestrian Wait Outputs and 1 Daily Event that are under the control of the main ATSC4 CPU.

When the CPU requires an output to be ON, it sends the appropriate message to the EIM microcontroller that interprets the message and sets the appropriate latched output ON.

An output is ON by pulling the relevant output line low to zero volts (0V) and the relay or other device connected to this drive is being supplied from the +24V dc being supplied by the XDY connector.

When an output is turned ON, it is latched and remains in that state until the CPU sends another message to turn it OFF or the controller is powered down, as the output is software latched at the module level.

3.3.3 *Connector Sensing and Keying*

The XEA and XDY have blinding (keying) pins fitted to ensure that the wander leads cannot be plugged into the wrong connector.

The XEA and XDY also have coding links in their associated wander leads to ensure the correct lead is plugged into the correct connector on the correct module if more than one module is installed.

Connector	Keying Pin	Coding Link
XEA	2 and 20	24 to 25
XEB	2 and 20	23 to 25
XDY	3 and 7	13 to 25

Table 10 EIM Connector Keying and Coding Links

If a wander lead is not installed then the associated Inputs and LED displays will be put into a “Locked On” state, causing a permanent demand.

For a detailed description of the External Interface Module please refer to the External Interface Module Technical Manual 400-TM-008.

3.4 Vehicle Detector Module (VDM)

The Vehicle Detector Module is an inductive loop based technology device.

The Vehicle Detector Module is supplied by ATC in two configurations. They are an 8 Channel version and a 16 Channel version.

The Vehicle Detector Module is fitted with 10 LEDs for the 8 Channel version and 18 for the 16 Channel version. The “PWR” Led will come on once the module is released from reset, it has determined that the supply voltage is OK and it has established comms into the system. If the “PWR” LED is blinking, then the voltage is OK however it cannot establish comms to the system.

The “FAULT” LED will be ON solid if there is a connector sense fault or ON blinking if there is a loop fault issue. The other 8 or 16 LEDs respectively are status LEDs of the presence of a detection or if permanently ON, then a possible fault associated with that individual channel.

The tuning of the detector is fully automatic. When power is applied to the detector upon installation of the system, or when a reset is initiated, the detector will automatically tune itself to the loop to which it is connected. The detector will tune to the loops in the inductance range shown in the table below:

Frequency Switch Setting	Minimum Inductance µH	Maximum Inductance µH
HIGH	20	1000
MED-HIGH	20	900
MED-LOW	20	800
LOW	20	700

Table 11 Inductance Tuning Ranges

This wide range ensures that all loop sizes and feeder combinations will be accommodated in the tuning range of the detector.

Once tuned, any slow environmental change in loop inductance is fed to a compensating circuit within the detector which keeps the detector correctly tuned.

Sensitivity of the detection system is dependent on factors such as loop size, number of turns in the loop, feeder length and the presence of metal reinforcing beneath the loop.

The nature of the application determines the required sensitivity which may be adjusted by means of the software sensitivity command.

The sensitivity levels of the detector have been carefully optimised for traffic applications. The detection of small unwanted objects can be eliminated by selecting lower sensitivity levels, whilst high bed vehicles and vehicle/trailer combinations will not cause multiple detections on the higher sensitivity settings.

3.4.1 *Power and Data*

A 96 way DIN41612 Type C connector, as well as a DB37 connector is used to allow connections to the detector module. The DC power is applied to the DIN41612 Type C connector, and the CAN Bus communication lines, detector card address lines and synchronous output and input lines are also via this connector. The loop inputs and connector sensing lines are via the DB37 connector.

3.4.2 *Retune Button*

The detector module automatically tunes to the inductive loops connected to it within 3 seconds after applying power. Should it be necessary to retune any of the detector modules, as may be required after changing the frequency settings of the detector module, depressing the retune button for more than 2 seconds will initiate the automatic tuning cycle. When the retune button is depressed, all settings will revert to their power up values as stored in the main CPU NVRAM and the detector microcontroller EEPROM memory. The retune button does not reset the CAN Bus communications section of the detector.

3.4.3 *Loop Numbering Addressing / Connector Sensing*

Each Vehicle Detector Module will have its own address decoded by which slot it is plugged into in the backplane. This will then provide the decoding used on pins 18, 19 and 36 on the DB37 connector which is located on the front of the detector card. This will determine if the card is XLD, XLL, XLX or XLY. From this, the detector is able to determine which wander lead it has connected to it to determine if the correct wander lead is connected.

Much like the detector card addressing, the VDM examines the connection status of these three pins to determine which loops it has connected to it. The following table will show the configuration of pins 18, 19 and 36 for detecting the correct wander lead.

Connector	Loop Numbers	Pin 18 Connections	Pin 19 Connections	Pin 36 Connections
XLD	1 to 16	Linked to Pin 36	N/C	Linked to Pin 18
XLL	17 to 32	N/C	Linked to Pin 36	Linked to Pin 19
XLX	33 to 48	Linked to Pin 19	Linked to Pin 18	N/C
XLY	49 to 64	Linked to Pin 19	Linked to Pin 36	Linked to Pin 18

Table 12 Connector Sensing Pin Configuration

Therefore if the first VDM detector card has loops 1 to 16 connected to its loop inputs, Pin 18 and 36 on the DB37 Way connector will be connected to each other. Similarly if loops 33 to 48 were to be connected to the VDM then Pins 18 and 19 will be connected to each other.

If the incorrect wander lead is connected then the detector will “Lock On” the status of ALL inputs that it reports to the main CPU.

If the associated wander lead is not connected correctly then the detector will ‘Lock On’ the status of ALL inputs that it reports to the main CPU.

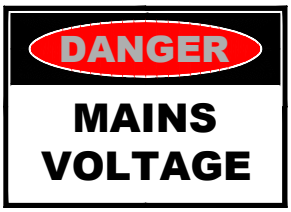
For a detailed description of the Vehicle Detector Module please refer to the Vehicle Detector Module Technical Manual 400-TM-009.

3.5 Signal Group Output Module (OPM)

3.5.1 Description

The OPM is specifically designed as a signal switching element that drives the signal aspects at a traffic intersection. It not only drives the signals ON and OFF, but also monitors their state irrespective of whether they're ON or OFF in order to detect induced voltages or short circuits that may have eventuated in the field cabling to the lamps.

The module is designed to drive up to 4 Signal Group Outputs comprising the three colours Green, Yellow and Red by switching nominal mains ac (or a lower dimmed voltage).



CAUTION – The 4 Group Output Module contains live Mains Voltage.

The OPM is designed for the ease of installation and operating parameters are configured at start-up from data in the personality. This data includes conflict data and ON / OFF state thresholds.

The OPM provides output indication in the form of LED's on the front of the signal group output card. Each group of three signals (Red, Yellow and Green) has a set of coloured LEDs that matches the group. There is also a single LED, which has a dual purpose of functioning as a power indicator as well as a CAN Bus communications error indicator.

The OPM card has a 15 Way Mate-N-Loc connector located on the front and provides connections for the 4 Signal Groups Output to the field. A 48 pin DIN41612 ½ Type C connector, and two (three) 3 pin H3 connectors located at the rear of the OPM card provides connection to the logic rack bus including: power, CAN Bus serial communications link, conflict lines and other timing functions.

The OPM is designed to cope with a wide dynamic range of loads and can control and monitor loads from 2 Watts up to 1200 Watt loads.

An overview of the OPM Module is provided in the following diagram on the next page in Figure 7 Output Module Block Diagram that shows the close coupling between this module and the Secondary Conflict Monitor located on the Power Supply Module.

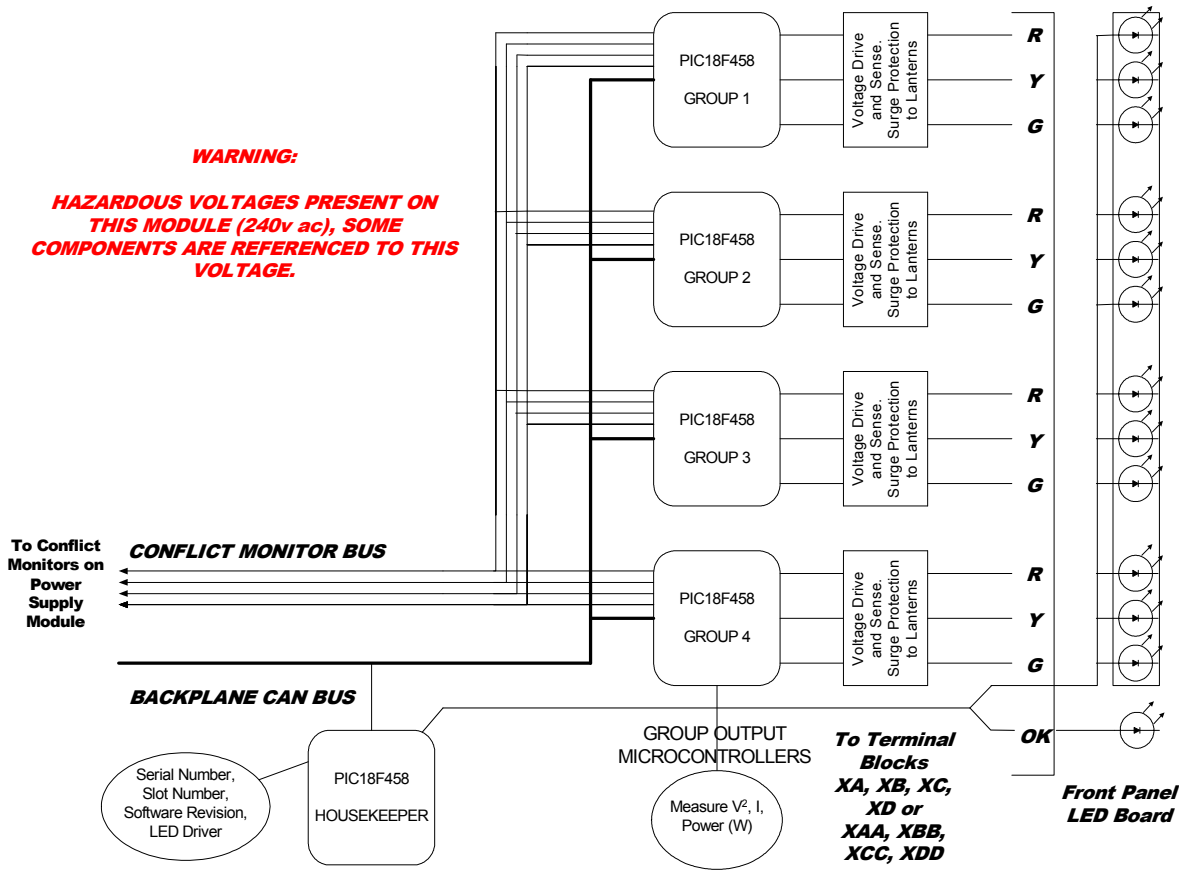


Figure 7 Output Module Block Diagram

3.5.2 *Lamp Output Control Microcontroller*

A single Micro Chip PIC microcontroller controls the three colour outputs for each signal group. The function of the microcontroller is to turn each of the outputs ON and OFF, control the operation of the dump or bypass circuit and to measure the output voltage and current of each output.

Each group is identical, therefore the same operation applies to all circuits. The power control and monitoring circuit is identical for each colour, therefore only one colour will be described.

These devices operate from individual -5V dc supply regulators supplied from the FP- supply.

The microcontroller is the Micro Chip PIC18F458.

3.5.3 *House Keeper Microcontroller*

The House Keeper Microcontroller is used to control some of the basic functions on the Lamp Output Board.

The functions provided are back plane location monitoring to determine the Group Number, Cable Keying monitoring to determine which cable is connected to the front of the output module and LED display to indicate which outputs are currently on.

The Housekeeper controller is the Micro Chip PIC18F458 U14.

This device operates from the regulated –5 V dc supply from REG1. The reference Voltage for this circuit is the Regulated Lamp Active Supply.

3.5.4 *Hardware Set-Up*

A 48 pin DIN41612 Type C Male R/A connector and two (2) 3 pin DIN41612 Type H Male R/A PCB mount connector for connection to the backplane, and a 15 way MATE-N-LOC connector is used to connect the OPM to the cabinet wander lead.

The AC power is applied to the OPC and OPD connectors and the data interface is via the DIN41612 Type C connector, the CAN Bus communication lines, signal group output card address lines and synchronous output and input lines are also via this connector. The lamp drive circuits and keying monitoring circuits are connected to the 15way connector.

An overview of the Signal Group Output Module is shown on the next page in Figure 8 OPM Outline Diagram:

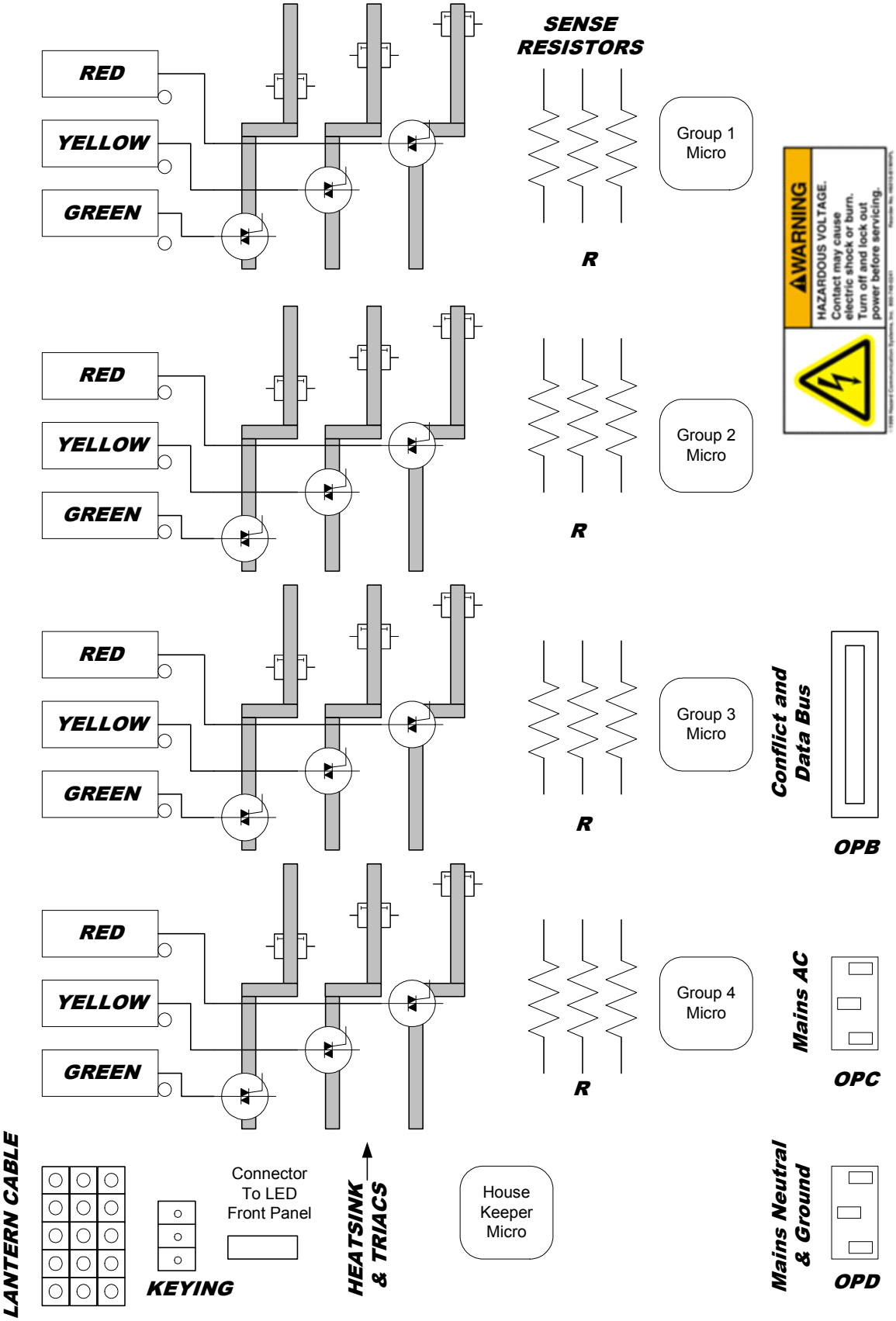


Figure 8 OPM Outline Diagram

3.5.5 *Connector Sensing and Keying*

Each OPM card has its own unique keying code. The OPM Housekeeper microcontroller is responsible for keeping track on the cables connected to it and which slot it is in and other functions such as the serial number etc.

The cable's unique code is configured on pins 13, 14 and 15 on the Mate-N-Loc connector, (see section 8.2), located on the front of the OPM card. The OPM signal group output is able to determine which module out of 8 OPM cards it is via keying on the backplane and therefore which cables it should have connected to it and uses this information when reporting the relevant group status to the LPM via the CAN Bus link.

The OPM Housekeeper microcontroller examines the connection status of these three pins to determine which cable it has connected to it.

The House Keeper PIC continuously monitors the cable keying to determine if the cable is removed or the wrong cable is connected to the Output Module.

The cable keying is provided by a combination of 1 or 2 diodes in the connected cable.

Driving the signals CONSETA_A5, CONSETB_A5 and CONSETC_A5, then reading the voltage on CONREADA_A5, CONREADB_A5 and CONREADC_A5 determines the diode combination.

The voltage divider formed by R14, R15, R16, F13, F14 and F15 along with the external diode enable the detection of each of the possible diodes.

Protection of the PIC microcontroller and associated circuits is provided by F13, F14, F15, V2, V3 and V4.

The following table shows the configuration of pins 13, 14 and 15 and to which group they correspond.

Connector	***Coding Diode 1***		***Coding Diode 2***	
	Anode	Cathode	Anode	Cathode
XA	13	14		
XB	14	13		
XC	15	14		
XD	14	15		
XAA	13	15		
XBB	15	13		
XCC	13	14	15	14
XDD	14	13	14	15

Table 13 Connector Keying Sensing Pins

3.5.6 *Software Set-Up*

As there are no DIP switches located on the OPM printed circuit board, all of the various options for configuring the signal group output are only software selectable.

The OPM starts off with no default values at power up and has these loaded down at start-up from the main CPU on the Logic Processor Module.

The functions defined in the controller personality and loaded to the OPM from the LPM during start-up include number of signal groups required, conflict table data, signal group type, threshold levels derived from the nominal mains ac level.

3.5.6.1 Conflict Generation and Monitoring

Each output PIC microcontroller will indicate when this group has an active output that may conflict with another group by activating one or more of the conflict lines CONFA_A1, CONFB_A1 and CONFC_A1. These outputs are diode OR'd by V72, V79 and V71 onto a common signal driving the bus driver V101, V100 and V99.

The back plane conflict signals FBCONFAFB(L), FBCONFBFB(L) and FBCONFCFB(L) are monitored by each group to determine when a conflict has occurred.

The Secondary Conflict Monitor (SCM) in the Power Supply Module continuously monitors the conflict lines and in the event of a conflict, will drop the Master Relay within 100ms.

For information regarding the operation of the Conflict Monitoring module please refer to the Power Supply Module Technical Manual document part number 400-TM-006.

For a detailed description of the Output Module please refer to the Output Module Technical Manual 400-TM-011.

3.6 Power Supply Module (PSM)

The PSM is primarily the unit that powers all modules installed within the ATSC4 Logic Rack.

3.6.1 Overview

The PSM is designed to accept Nominal Mains ac and provide a bulk DC supply to all the ATSC4 modules in the Logic Rack as well as provide a number of other functions such as timing and Start-up signalling, system conflict monitoring, ac mains voltage monitoring, Lamp Supply dimming, interfacing interlocks to the Master and Auxiliary relays within the ATSC4 Signal Controller housing.

The PSM also houses the Secondary Conflict Monitor that is composed of two identical halves, one of which is embedded on the PSM and the other connected via an internal bus as a daughter board.

A block diagram illustrates the implementation of the various sub-circuits and is shown in Figure 9 Power Supply Module Block Diagram.

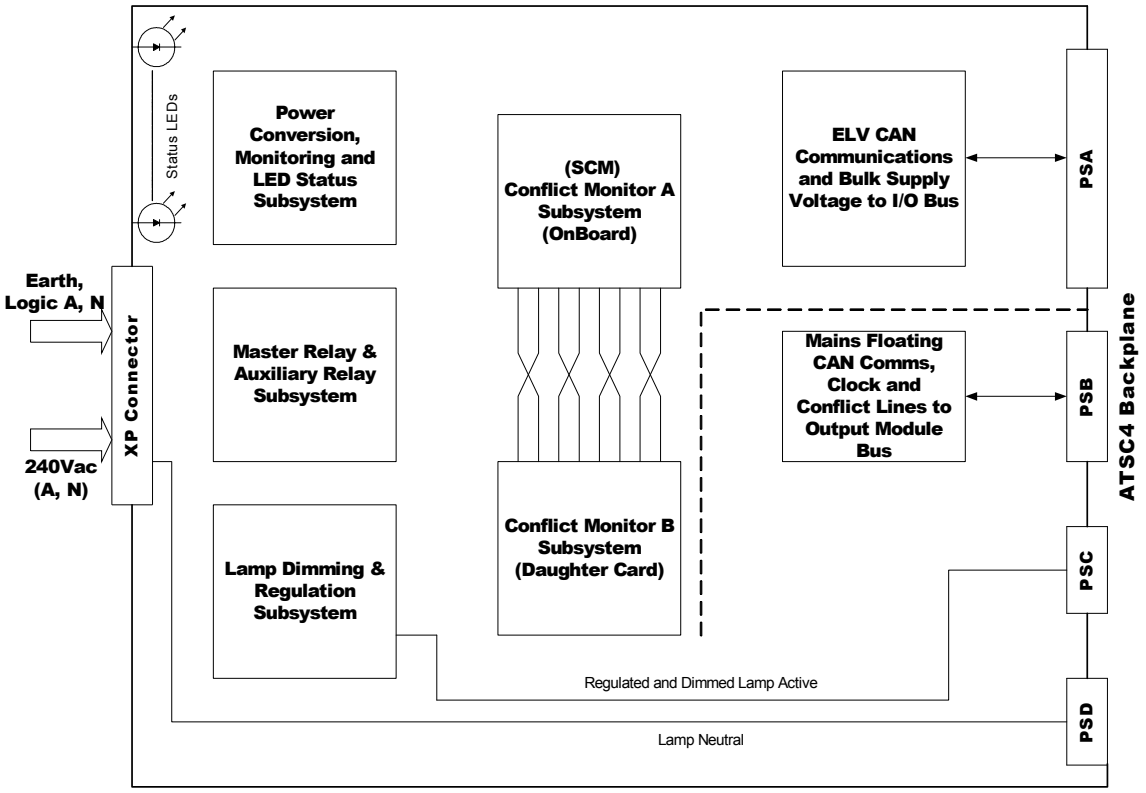


Figure 9 Power Supply Module Block Diagram

The above is a simplified view, however there are many smaller subsystems that are actively part of the PSM. Below are the visual indicators of the module that includes status information of the Secondary Conflict Monitor module.

The power supply module supplies a main bulk +24Vdc rail to the I/O and Logic Processor modules within the Logic Rack that convert that voltage local to one or more as required by each module.

An isolated FP- supply is used to supply voltage to the output modules.

It also supplies a number of other voltages used onboard and by the Output Module as part of the System Conflict Monitor Sub-system.

3.6.2 *Front Panel Facilities*

The PSM is fitted with a number of LED indicators to show the operating condition of the PSM.

3.6.2.1 LED Indicators

The LED's are numbered from the top down as H1 to 10 and described below:

H1, Power ON, the mains supply is greater than the minimum supply voltage.

H2, Over Voltage, the mains supply is greater than the maximum supply voltage.

H3, Start up, the SCM is in start up.

H4, Watchdog, the system Watchdog timer has expired. .

H5, CFMA LATCHED, the Conflict latch in the A SCM is set.

H6, CFMA INIT, the hardware start up timer on the A SCM is running.

H7, CFMB LATCHED, the Conflict latch in the B SCM is set.

H8, CFMB INIT, the hardware start up timer on the B SCM is running.

H9, +24 Volts OK, this indicates the supply rail is high enough to run the system.

H10, CFMA and B Conflict, when both the A and B conflict latches are set.

3.6.3 *Conflict Monitor Module*

The "Secondary" conflict monitor, commonly known simply as the Conflict Monitor is located on the Power Supply Module and is a purely hardware based conflict monitor to the Primary software conflict monitor running in the Logic Processor Module.

For more detailed information on the Power Supply Module please refer to the Power Supply Technical Manual 400-TM-006.

3.7 Special Facilities Module (SFM)

The Special Facility Module is an optional module and is not always fitted to a controller.

Each SFM module has 12 input and 12 output circuits that interface via a DB37 female connector to a wander lead in the controller cabinet.

Special Facility Inputs and Outputs 1 – 12 are on the XSF module.
Special Facility Inputs and Outputs 13 – 24 are on the XXF module.

The operation of the input and output sections of the SFM are as per the EIM and so the description will not be repeated here. Refer to the operation of the EIM circuits for a description on the circuit functionality.

3.7.1 Connector Sensing

The XSF and XXF connectors have blinding pins fitted to ensure that the wander leads cannot be plugged into the wrong connector.

The XSF and XXF also have coding links in their associated wander leads to ensure the correct lead is plugged into the correct connector on the correct module if more than one module is installed.

Connector	Keying Pin	Coding Link
XSF	19 and 20	28 to 29
XXF	19 and 20	27 to 29

Table 14 EIM Connector Keying and Coding Links

If a wander lead is not installed then the associated Inputs will be put into a “Locked On” state, causing a permanent demand.

For a detailed description of the Special Facility Module please refer to the Special Facility Module Technical Manual 400-TM-010.

4 Installation Procedure

This section gives a brief description of the procedures to be performed during the installation of an ATSC4 Traffic Signal Controller at a traffic signal controlled intersection.

For detailed instructions on installation and commissioning of an ATSC4 Traffic Signal Controller please refer to manual 400-FM-003, Installation and Commissioning, located in a later section of this Field Manual Folder.

It is recommended that prior to site installation that all traffic signal controllers have a pre-installation burn-in test performed. For an ATSC4 controller, the procedure is described in ATC Document Part Number: 400-TM-002 “ATSC4 Controller Pre-Installation Preparation Procedure”.

4.1 Physical Installation

The following sections give bullet point items for consideration during these relevant steps of installation as each installation can differ from the next in many ways.

4.1.1 Site Preparation

The following should be observed before starting any work on the site:

- Site should be safe for workers and public.
- Mounting plinth should be checked for suitability of use before attempting to fit the ATSC4 controller housing onto it.

4.1.2 Cabinet Installation

Points are supplied on the housing for use of a strap for lifting of housing into place by a small truck mounted lifting unit.

4.1.3 Cable Terminations

Cabling should be correctly secured by use of the Strain Relief straps fitted at the bottom of the Equipment Mounting Panel and Loop Termination Panels.

Cabling should be labelled for easy identification of cable runs and loop feeders.

4.1.4 Telecommunications Line Termination

Telecommunications lines originating from outside the housing should not be exposed internally within the housing and should be within conduit up to the Line Interface Unit (LIU).

Work on the telecommunications lines should only be performed by appropriately licensed personnel to ACA standards.

The Line Termination provided by the ATSC4 meets all required telecommunications standards for interfacing to POTS lines.

4.2 Configuration of Site ID Unit

The SITE ID Card is located on the right hand side of the cabinet above the shelf and can be easily configured by removal of one or more diode links that are on the board. Doing so, sets the unique ID value for that site that matches the value set in the Personality Cardbus Card.

The Site ID consists of 2 fields, one 5 digit value and a single letter revision value. The five digits are set in Binary Coded Decimal each, with the left most digit being the Most Significant Bit (msb) and the right most being the Least Significant Bit (lsb).

The format for the Site ID data nibble is : msb .. .. lsb.

Going from left to right the MSB is the “Ten Thousands” digit, the second is the “Thousands” digit, the third is “Hundreds”, the fourth is “Tens” and LSB is “Units”.

4.2.1 How to Set a SITE ID

In this section the setting of a sample Site ID value is shown to configure a new Traffic Signal Controller.

In this example, the sample site ID value to be set is: **64923-D**.

As mentioned in the previous sub-section above, cutting diodes from the PCB sets the value, so to set the five values simply cut the diodes for each digit so they “add-up” to that digit in binary arithmetic.

Therefore, any number can be made up by adding in combinations of 8, 4, 2 or 1.

Each digit can be calculated as follows:

$$1 * 2^4 + 1 * 2^3 + 1*2^2 + 1*2^1 + 1*2^0 = \text{Decimal Value}$$

A “1” is used to multiply each bit IF the bit position is valid, that is $1 * 2^3$ is only added if the value “8” (2^3) is part of the addition to get a value of 9 (which is 8 + 1, $2^3 + 2^0$).

8 + 0 + 0 + 1 = 9 this means bits 3 and 0 are cut to set the value to 9.

For example, to set the value “4”, cut the diode labelled “4” (= 2^2) in the group labelled “Thousands”. To set the second digit which is a “9”, cut the diodes labelled “8”, and then the one labelled “1” (2^0) in the group labelled “Hundreds” (i.e. ten thousands, thousands, hundreds, tens, units).

Repeat this process for all 5 digits of that site.

The Revision of the Site ID simply requires that all diodes up to a given revision level be removed.

ATC ship the Site ID Revision with a default value of “A” and as such is not fitted when it leaves the factory.

Therefore, to set the Revision value to “D”, simply remove diodes “B” and “C”, given that “A” is the default with all revision diodes fitted.

The final result of this configuration is shown in Figure 10 Sample Setting Site ID Value.

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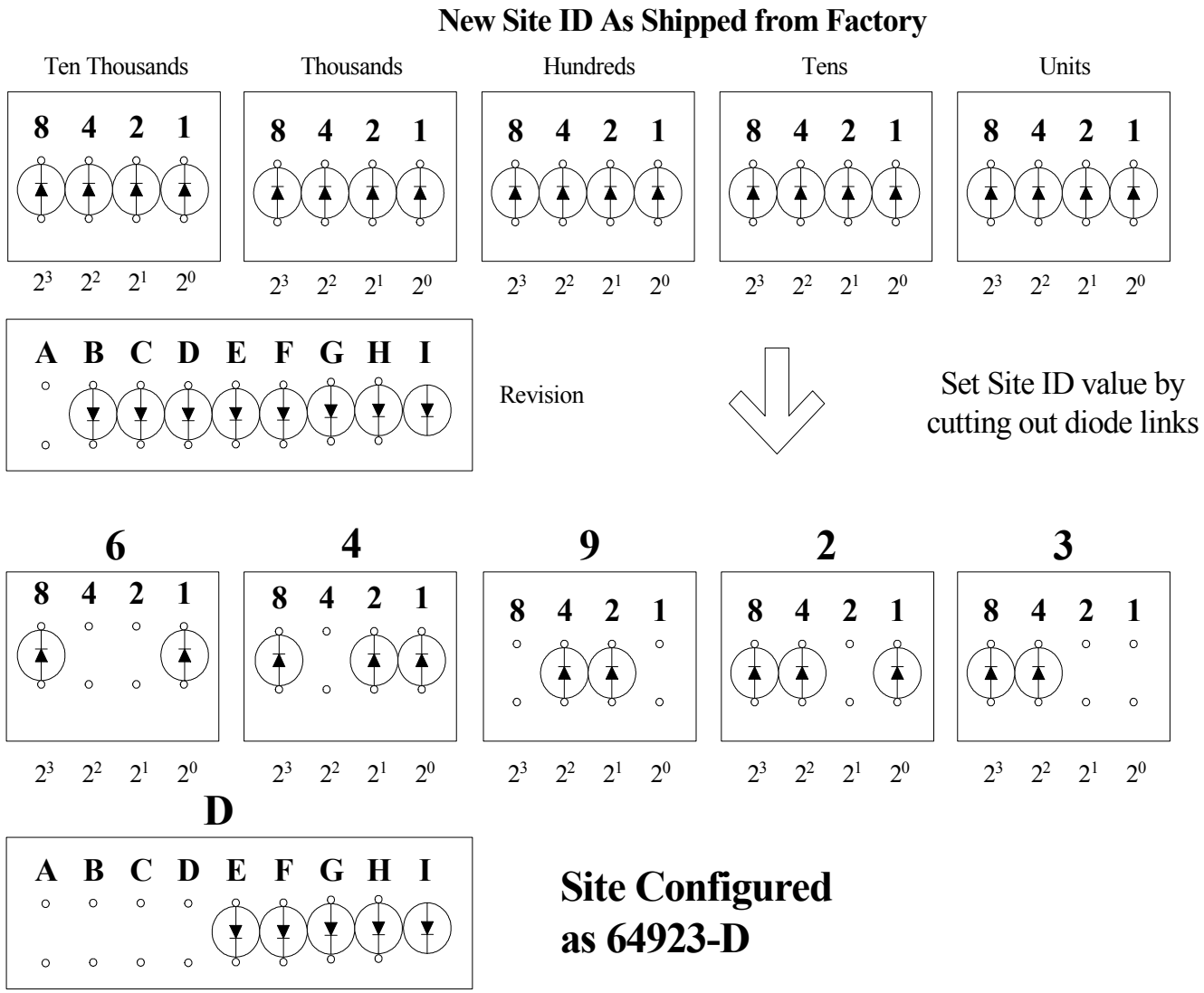


Figure 10 Sample Setting Site ID Value

5 Diagnostic Options

This section details what diagnostic features are available for the ATSC4 controller.

5.1 Visual Indicators

5.1.1 Power LEDs

The ATSC4 controller has visual indicators as LEDs on all modules fitted to the Logic Module.

The Power LED on the Logic Processor, External Interface Module, Special Facility Module, Output Module and Vehicle Detector modules indicates when in the STEADY ON state that the voltage to the module and CAN BUS communications to the module is OK.

If the Power LED on one of these modules is flashing at a steady rate, then that module voltages are OK however that module cannot communicate to the CAN BUS and thus not communicate to the system

The POWER ON LED on the Power Supply indicates that the nominal mains is high enough for the Power Supply to run.

5.1.2 Vehicle Detector Fault LED

The LED on the Vehicle detector has two functions. It flashes when there is a loop fault on any loop channel that is turned on. The second function is the Fault LED is locked on, then that indicates that there is a connector sense fault. Either the wander lead connector is not plugged in correctly or the wrong wander lead connector is plugged in to the detector.

Also note that an open circuit or short circuit loop will lock the associated detector channel LED to the Steady On state.

5.1.3 External interface Module

If the External Interface Module has either no 28Vac supply from the transformer in the cabinet or no zero crossing reference from the backplane, then all the external input LEDS will be Locked On and the associated inputs to the controller also Locked On.

5.1.4 Output Module

If the controller enters Fault Mode, then depending on the fault type the LED of the signal group displays could represent one of the following states. The signal group colours at the time of a Secondary Conflict Monitor detected conflict. For a Lost red Fault, the red LED of the signal group involved will be ON. If an illegal display has been detected by the Secondary Conflict Monitor, then the state of the group at fault will be displayed.

5.2 When in Fault Mode

If the controller is in Fault Mode, it is recommended that the state of the LEDs on the Logic Processor Module and the Power Supply Module be recorded.

The status of these LEDs can be of assistance in diagnosing the fault at a later date if the fault becomes repeated.

Also recording a copy of the Fault / Error log can be of assistance at a later time when diagnosing a fault.

5.3 Maintenance / Test Mode Operation

Please refer to the Hand Held Terminal Quick Reference Guide for instructions on entering the controller into Test Mode for field wire testing. This document can be found located in another section of this Field Manual Folder.

6 ATSC4 Controller Start-Up Sequence

The Logic Processor Module front panel LEDs have been programmed to give an indication of the progressive state of the start-up sequence. When the start-up is complete and the signals are Lamps On, the front panel LEDs revert to an indication of the status described by the adjoining front panel text.

Note that the LED statuses shown pictorially in Document 400-TM-025 are applicable when the step is completed.

The ATSC4 controller start-up sequence is divided into two sections – cold start and warm start.

The cold start section is the sequence that occurs immediately after power is applied. In this period the CPU starts up, initialises the real time executive and makes a number of basic checks on the hardware. If the CPU does start successfully but there is some other failure during this period – the bottom eight CPU LEDs flash at a 1Hz rate and the XHHT port is active to indicate the nature of the start-up failure. The cold start will be re-activated only on a further power down – power up sequence.

When the cold start section is successfully completed, the warm start sequence is activated. The warm start sequence is re-activated each time the controller moves from FLASH / OFF to Lamps On.

Please refer to Document 400-TM-025 for the complete pictorial display of these steps. This document is located in a later section of this Field Manual Folder.

7 Fault and Error Codes

7.1 Introduction

This section details the step-by-step procedure to observing, testing and diagnosing the module for correct operation.

The fault / error codes detailed in Document 400-TM-024 relate to those reported by the individual modules back to the main CPU of the controller and those of the CPU itself.

Care should be taken at all times when running monitoring software on a live intersection as any actions carried out by service personnel via these tools may have an adverse effect on the traffic signals on display.

7.2 Hardware Required

A Laptop PC with a Serial Cable or a hand-held PDA (ATC support the Palm Pilot and HP iPAQ) along with a serial cable to plug into the XHHT port of the Logic Processor.

Device	Serial Cable Part Number
Laptop PC	
PC Serial Cable	
USB to Serial Converter	TC108-118
4x40 ANSII Terminal	TC400-05
Windows Mobile PDA	TC400-04

Table 15 ATSC4 User Interface List

Note that laptops that are equipped with USB only ports can use a USB to RS-232 converter for serial communications.

7.3 Software Required

A copy of the ATC Use Interface software program loaded on either a Laptop PC running MS-Windows or a hand-held Windows Mobile Device (eg: HP iPAQ) with its version of the ATSUI running in order to interact with the monitor program running on the ATSC4 controller.

The 4x40 ANSII Hand Held Terminal is supported directly via a serial connection to the XHHT Port using the embedded Hand Held Terminal code supplied with the TRAFF software.

7.4 Fault and Error Code Descriptions

The Fault / Error Codes described here are those reported by the ATSC4 traffic signal controller.

As such these fault / errors codes are particular to ATC and do not correlate with those of other traffic signal controllers and indicate errors particular to the internal workings of the ATSC4 controller modules.

All fault / error codes up to 255 are those that are generic to the TRAFF software.

All fault / error codes from 800 and above are allocated to the ATSC4 controller.

Please refer to Document 400-TM-024 found in a later section of this Field Manual Folder or refer to the Hand Held Terminal Quick Reference Guide for a listing and detailed description of each fault and error code.

8 Connector and Cable Location Reference

This section provides a list of the connectors and signals carried on those pins that can be used for signal tracing and verification on site or in the workshop.

8.1 Cable Location Reference

This section provides a grid reference that all cables in this section use to detail the start and ending coordinates of a cable within the ATSC4 Housing.

8.1.1 Cabling Locations A - Z

Location	Location Description	End 'A'	End 'B'	Comment
A	Main Fuse Cartridge	Street	M_SW	32 Amp HRC Fuse Fitted
B*	Main Switch	Fuse	Filter	32 Amp CCB
C	Surge Diverter	E/L	M_SW	
D	Filter Unit	Line	Load	
E	Neutral Link – N/L 1	Street	Filter	
F	Earth Link – E/L 1	Street	Various	
G	Neutral Link – N/L 2	Filter	Various	
H	CCB Busbar	Filter	CCBs	
I	CCB Load Side	CCBs	Various	
J	32Vac Transformer	240V ac	32Vac	
K	Auxiliary Switch			
L	Auxiliary Terminal Block	Aux Rly		
M	Master Relay			
N	Auxiliary Relay			
O	Flasher Unit - XFP			
P	GPO			ELCB Type
Q	Logic Power Conn - XP			
R	'A' Field Terminal Strip			
S	'B' Field Terminal Strip			
T	'C' Field Terminal Strip			
U	'D' Field Terminal Strip			
V	'E' Field Terminal Strip			

Location	Location Description	End 'A'	End 'B'	Comment
W	'AA' Field Terminal Strip			
X	'BB' Field Terminal Strip			
Y	'CC' Field Terminal Strip			
Z	'DD' Field Terminal Strip			

Table 16 Cabling Locations A – Z

***Note:** A second Miniature Circuit Breaker can be installed at location as a supply to a Top Hat assembly if fitted. This MCB is typically a 16A Type 'C' curve breaker.

8.1.2 *Cabling Locations AA -ZZ*

Location	Location Description	End 'A'	End 'B'	Comment
AA	'A' Terminal FCO Relay			
BB	'B' Terminal FCO Relay			
CC	'C' Terminal FCO Relay			
DD	'D' Terminal FCO Relay			
EE	Equipment Mounting Panel Earth Point			Lower Right hand Side
FF	Equipment Mounting Panel Earth Point			Lower Left hand Side
GG	Loop Panel Earth Link			
HH	Rear Earth Stud			Left Hand Body Wrap
II	Front Earth Stud			Left Hand Body Wrap
JJ	Door Earth Stud			
KK	Gas Sensor Conn			
LL	L.I.U. Earth Stud			Right Hand Body Wrap
MM	L.I.U. Comms Conn			
NN	L.I.U. Earth Conn			
OO	Site ID Board - ZID			
PP	Flasher Unit - ZFL			
QQ	Door Switch - ZDR			
RR	Gas Sensor - ZGS			
SS	Light Sensor - ZLS			
TT	Master Relay – ZMR			Relay Controls
UU	Police Panel – ZPP			
VV	Facility Switch - ZSW			
WW	Flasher Unit – XFC			
XX	XID Connector			
YY	XM Connector			
ZZ	XTTY Connector			

Table 17 Cabling Locations AA – ZZ

8.1.3 *Cabling Locations AZ - YZ*

Location	Location Description	End 'A'	End 'B'	Comment
AZ	XEA Connector			
BZ	XEB Connector			
CZ	XDY Connector			
DZ	XLD Connector			
EZ	XLL Connector			
FZ	XLD – Loop Panel			
GZ	XLL – Loop Panel			
HZ	XA Connector			
IZ	XB Connector			
JZ	XC Connector			
KZ	XD Connector			
LZ	XAA Connector			
MZ	XBB Connector			
NZ	XCC Connector			
OZ	XDD Connector			
PZ	Daily Settings Relay			Optional
QZ	Aux Term Block – Surge Diverter			
RZ	Flasher Unit – Internal PCB Connections			
SZ	XHHT Connector			
TZ	Door Switch			
UZ	Light Sensor			
VZ	Facility Switch			
WZ	Police Panel			
XZ	Equipment Mounting Panel Earth Point			Upper Left Hand Side
YZ	Shelf Earth Point			Left Hand Side

Table 18 Cabling Locations AZ – YZ

8.2 Equipment Panel Main Loom Wiring

Refer to Drawing No. TC400-110 located in Tab Section 10.

The Tab Section 10 is located in a later section of this Field Manual Folder.

8.3 Flasher Unit

Refer to Drawing No. TC400-87 located in Tab Section 10.

Description: XFP to Flasher Internal PCB Connection points

Cable Location: Internal of Flasher Unit

8.4 Site ID Module

8.4.1 Site ID to Master Relay and Auxiliary Relay Control (ZMR)

Refer to Drawing No. TC400-104 located in Tab Section 10.

Cable Locations: TT to M & N

8.4.2 Site ID to 3 Position Facility Switch (ZSW)

Refer to Drawing No. TC400-100 located in Tab Section.

Cable Locations: VV to VZ

8.4.3 Site ID to 5 Position Facility Switch (ZSW)

Refer to Drawing No. TC400-102 located in Tab Section 10.

Cable Locations: VV to VZ

8.4.4 Site ID to Door Switch (ZDR)

Refer to Drawing No. TC400-103 located in Tab Section 10.

Cable Locations: QQ to TZ

8.4.5 *Site ID to Flasher XFC Connector (ZFL)*

Refer to Drawing No. TC400-105 located in Tab Section 10.

Cable Locations: PP to WW

8.4.6 *Site ID to Light Sensor (ZLS)*

Refer to Drawing No. TC400-148 located in Tab Section 10.

Cable Locations: SS to UZ

8.4.7 *Site ID to Gas Sensor (ZGS)*

Refer to Drawing No. TC400-158 located in Tab Section 10.

Cable Locations: HH to BB

8.5 ATSC4 Facility Switch Contacts

8.5.1 3 Position Switch

	OFF	FLASH	ON
Contact 1 - 2	X	-	-
Contact 3 – 4	-	X	X
Contact 5 – 6	-	-	X
Contact 7 – 8	X	X	-
Contact 9 - 10	-	X	X
	A	**A+B**	**B**

Table 19 Three Position Facility Switch Pin Connections

Contact 1 –2 is Flash Disable
Contact 3 – 4 is Auxiliary Relay Coil Control
Contact 5 – 6 is Master Relay Coil Control
Contact 7 – 8 is CONTACT ‘A’
Contact 9 – 10 is CONTACT ‘B’

8.5.2 5 Position Switch

	OFF	FLASH	ON	MANUAL	STEP
Contact 1 - 2	X	-	-	-	-
Contact 3 - 4	-	X	X	X	X
Contact 5 - 6	-	-	X	X	X
Contact 7 - 8	X	X	-	-	-
Contact 9 - 10	-	X	X	X	-
Contact 11 - 12	-	-	-	X	X
	A	**A+B**	**B**	**B+C**	**C**

Table 20 Five Position Facility Switch Pin Connections

Contact 1 –2 is Flash Disable
Contact 3 – 4 is Auxiliary Relay Coil Control
Contact 5 – 6 is Master Relay Coil Control
Contact 7 – 8 is CONTACT ‘A’
Contact 9 – 10 is CONTACT ‘B’
Contact 11 – 12 is CONTACT ‘C’

8.6 External Inputs XEA to 'E' Terminal Strip

Refer to Drawing No. TC400-108 located in Tab Section 10.

Cable Locations: AZ to V

8.6.1 Pedestrian Wait Outputs (XDY)

Refer to Drawing No. TC400-109 located in Tab Section 10.

Cable Locations: CZ to OZ

This cable and associated termination strip are optional and not always fitted to a controller.

8.7 XID to ZID Connector on Site ID

Refer to Drawing No. TC400-101 located in Tab Section 10.

Cable Locations: XX to OO

8.8 XLD to XLD Connector on Loop Panel

Refer to Drawing No.TC400-112 located in Tab Section 10.

Cable Locations: DZ to FZ

NOTE: The XXL Loom TC400-132 has the identical pin-outs to the TC400-112 loom.

8.9 Signal Group Outputs 1 – 4 (XA)

Refer to Drawing No. TC400-106 located in Tab Section 10.

Cable Locations: HZ to R

8.10 Signal Group Outputs 5 – 8 (XB)

Refer to Drawing No. TC400-107 located in Tab Section 10.

Cable Locations: IZ to S

8.11 Signal Group Outputs 9 -12 (XC)

Refer to Drawing No. TC416-106 located in Tab Section 10.

Cable Locations: JZ to T

8.12 Signal Group Outputs 13 – 16 (XD)

Refer to Drawing No. TC416-107 located in Tab Section 10.

Cable Locations: KZ to U

8.13 Signal Group Outputs 17 – 20 (XAA)

Refer to Drawing No. TC424-106 located in Tab Section 10.

Cable Locations: LZ to W

8.14 Signal Group Outputs 21 24 (XBB)

Refer to Drawing No. TC424-107 located in Tab Section 10.

Cable locations: MZ to X

8.15 XM to Line Isolation Unit

Refer to Drawing No. TC400-58 located in Tab Section 10.

Cable Locations: YY to MM

8.16 Police Panel Interface

This interface is allocated for future possible overseas use.

The Tab Section 10 is located in a later section of this Field Manual Folder.

9 Parts List

This section is a tabular listing of all the parts of this ATSC4 module.

Item	ATC Part Number	Description
1	PC0123	LAMPS MCB 20A 10KA
2	PC0122	FLASH MCB 16A 10KA
3	PC0120	LOGIC MCB 6A 10KA
4	PC0120	DETECTORS MCB 6A 10KA
5	PC0122	AUXILIARY MCB 16A 10KA
6		Spare for Ancillary MCB
7	PP0110	SWITCH BASE ARCHITRAVE SIZE (OPTIONAL)
8	PP0111	SINGLE POLE AUX. SWITCH (OPTIONAL)
9	PC0110	SURGE DIVERTER
10	PC0124	MAIN MCB 32A 10KA
11	PF0104	FUSE HOLDER FC32A
12	PF0105	FUSE NS32A
13	PL0329	NEUTRAL LINK 12 WAY L12 C/W COVER
14	PF0107	EMI MAINS FILTER
15	PL0329	EARTH LINK 12 WAY L12 C/W COVER
16	PL0328	NEUTRAL LINK 7 WAY L7 C/W COVER ~~ C G
17	TC400-25	POWER SUPPLY MODULE
18	R8095	BLANKING PANEL 4 GROUP OUTPUT MODULE
19	TC400-240	4 GROUP OUTPUT MODULE (GROUPS 29 – 32)
20	TC400-240	4 GROUP OUTPUT MODULE (GROUPS 25 – 28)
21	TC400-240	4 GROUP OUTPUT MODULE (GROUPS 21 – 24)
22	TC400-240	4 GROUP OUTPUT MODULE (GROUPS 17 – 20)
23	TC400-240	4 GROUP OUTPUT MODULE (GROUPS 13 – 16)
24	TC400-240	4 GROUP OUTPUT MODULE (GROUPS 9 – 12)
25	TC400-240	4 GROUP OUTPUT MODULE (GROUPS 5 – 8)
26	TC400-240	4 GROUP OUTPUT MODULE (GROUPS 1 – 4)
27a	TC408-80	DETECTOR MODULE 8 CHANNEL
27b	TC416-80	DETECTOR MODULE 16 CHANNEL (LOOP CH'S 1- 16)
28	R8080	BLANKING PANEL – DETECTOR (LOOP CH'S 1 – 16)
29a	TC408-80	DETECTOR MODULE 8 CHANNEL
29b	TC416-80	DETECTOR MODULE 16 CHANNEL (LOOP CH'S 17- 32)
30	TC400-65	EXTERNAL INTERFACE MODULE 16 CHANNEL
32	R8080	BLANKING PANEL – SPARE
33	TC400-45	LOGIC PROCESSOR MODULE
34	PF0715	FUSE 3A M5 X 20 - DELAY TYPE
35	-	28V WINDING
36	PS8015	SUPPRESSOR B-22nf 100R (OPTIONAL)
37	-	240V SUPPLY FOR TRANSFORMER
38	R7020	CONTROLLER CABINET ROOF
39	R7920	CONTROLLER EQUIPMENT SHELF
40	TC400-70	LOOP TERMINATION PANEL
41	PL0325	EARTH LINK 7 WAY L7A

Item	ATC Part Number	Description
42	R7255	LOOP TERMINATION PANEL MOUNT
43	R7115	FIELD CABLE STRAIN RELIEF
44	R7017	HINGE
45	TC432-1	FIELD TERMINALS AA BLOCK
46	TC432-2	FIELD TERMINALS AA BLOCK C/W COVER
47	TC432-1	FIELD TERMINALS BB BLOCK
48	TC432-2	FIELD TERMINALS BB BLOCK C/W COVER
49	TC432-1	FIELD TERMINALS CC BLOCK
50	TC432-2	FIELD TERMINALS CC BLOCK C/W COVER
51	TC432-1	FIELD TERMINALS DD BLOCK
52	TC432-2	FIELD TERMINALS DD BLOCK C/W COVER
53	TC400-55	SPECIAL FACILIT MODULE
54	PR0325	F.C.O. RELAY 24VDC COIL
55	PR0326	Relay Base
56	PR0325	F.C.O. RELAY 24VDC COIL
57	PR0326	Relay Base
58	PR0325	F.C.O. RELAY 24VDC COIL
59	PR0326	Relay Base
60	PR0325	F.C.O. RELAY 24VDC COIL
61	PR0326	Relay Base
62	TC416-1	FIELD TERMINAL E BLOCK
63	TC416-7	FIELD TERMINAL E BLOCK C/W COVER
64	TC416-2	FIELD TERMINAL D BLOCK
65	TC416-8	FIELD TERMINAL D BLOCK C/W COVER
66	TC416-2	FIELD TERMINAL C BLOCK
67	TC416-8	FIELD TERMINAL C BLOCK C/W COVER
68	TC416-2	FIELD TERMINAL B BLOCK
69	TC416-8	FIELD TERMINAL B BLOCK C/W COVER
70	TC416-2	FIELD TERMINAL A BLOCK
71	TC416-8	FIELD TERMINAL A BLOCK C/W COVER
72	R7115	FIELD CABLE STRAIN RELIEF
73	R7117	MAINS CABLE STRAIN RELIEF
74	R7230	CONTROLLER CABINET DOOR
75	-	DOOR LOCK (TYPE AND KEYED TO ORDER)
78	PP0915	COVER TRANSFORMER ATSC4
79	PR0320	AUX. RELAY
80	PR0320	DAILY EVENT RELAY (OPTIONAL)
81	PR0320	MASTER RELAY
82	PT0608	TRANSFORMER 240-28V 3A (96VA)
83	PT0337	TB TERMINAL BLOCK
84	PT0338	TB TERMINAL BLOCK COVER
85	PP0906	COVER - SWITCH BOARD / FILTER
86	-	MAIN EARTH STUD
87	TC400-145	PHOTO TRANSISTOR MODULE
88	PP0912	PHOTO TRANSISTOR SPACER
89	PP0911	PHOTO TRANSISTOR COVER
90	PS2120	DOOR SWITCH

Item	ATC Part Number	Description
91	PS2175	FACILITY SWITCH 3 WAY
92	PS2176	FACILITY SWITCH 5 WAY
93	TC400-60	SITE ID UNIT
94	TC400-10	LINE ISOLATION UNIT
95	PC2004	CONDUIT SADDLE
96	TC400-85	FLASHER
97	PC0111	TELECOM CONDUIT
98	PP0102	GENERAL PURPOSE POWER OUTLET BASE
99	PP0103	GENERAL PURPOSE OUTLET C/W EARTH LEAKAGE
100	TC400-130	GENERATOR CHANGE OVER SWITCH (OPTIONAL)
101	TC400-155	GAS SENSOR (OPTIONAL)
102	TC400-15	FILTER CAPACITOR MODULE
103	R8285	GENERATOR CABLE ENTRY HATCH
104	PG0630	GROMMET RUBBER
105	PB0612	BOLT M10 EYE

Table 21 ATSC4 Wired Housing Assembly List

10 Labelling

10.1 Housing and Door

No	Drawing Number	Title
1.	PN0362	Door Label Cabinet Overview
2.	PN0363	Door Label Wiring Diagram
3.	PN0396	Door Label Danger - Large
4.	PN0370	Equipment Panel Label Set
5.	PN0376	Cabinet Serial Number Label

Table 22 ATSC4 Labelling List

11 References

This is a list of documents that are either referenced in this specification or that may provide further information on the operation of the Unit.

Document Name / Number	Location
ATSC4 Technical Manual Folder	ATC Document 400-TM-000
ATSC4 User Interface Manual	ATC Document 400-TM-002
ATSC4 Flasher Unit Technical Manual	ATC Document 400-TM-003
ATSC4 Site Identification Unit Technical Manual	ATC Document 400-TM-004
ATSC4 Backplane Module Technical Manual	ATC Document 400-TM-005
ATSC4 Power Supply Module Technical Manual	ATC Document 400-TM-006
ATSC4 Logic Processor Module Technical Manual	ATC Document 400-TM-007
ATSC4 External Input Module Technical Manual	ATC Document 400-TM-008
ATSC4 Vehicle Detector Module Technical Manual	ATC Document 400-TM-009
ATSC4 Special Facility Module Technical Manual	ATC Document 400-TM-010
ATSC4 4 Group Output Module Technical Manual	ATC Document 400-TM-011
ATSC4 Loop Termination Panel Technical Manual	ATC Document 400-TM-013
ATSC4 Line Isolation Unit Technical Manual	ATC Document 400-TM-014
ATSC4 AC Subsystem Technical Manual	ATC Document 400-TM-015
ATSC4 Gas Sensor Unit Technical Manual	ATC Document 400-TM-018
ATSC4 Circuit Schematics	ATC Document 400-TM-019
ATSC4 Fault Codes Manual	ATC Document 400-TM-024
ATSC4 Start-up Sequence	ATC Document 400-TM-025
ATSC4 Wiring Diagram	Drawing PN0362
ATSC4 Layout Diagram	Drawing PN0363
RTA Equipment Specification No TSC/4 (including Amendment No 1)	RTA.
Associated Drawings For TSC/4 (including Amendment No 1)	RTA.

Table 23 Unit Document Reference List

11.1 Applicable Standards

The applicable standards are as per the TSC/4 requirements and the most salient ones are listed in the table below:

Standard	Description
AS1768	Lightning Protection
AS2144	Traffic Signal Lanterns
AS 2546.3	Printed Boards - Design and Use
AS3000	Electrical Wiring
AS3008	Electrical Installation: Selection of Cables – AC Voltages up to 0.6/1kV
AS60068	Environmental Testing
AS60950	Information Technology Equipment – Safety – Part 1 General Requirements.
AS61000	Electromagnetic Compatibility.
AS61508	Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems.
IEC 60027-2	Letter symbols to be used in electrical technology - Part 2: Telecommunications and electronics
ITU-T V.34	V34 Leased Line Point to Point Modem Communications Standard.

Table 24 Applicable Complinace Standards

12 ATSC4 Module Part Numbers

This section contains a reference table of all the Aldridge Traffic Controller Part Numbers for the main modules of the ATSC4 Traffic Signal Controller.

Module Name	Module Part Number	Description
LIU	TC400-10	Line Isolation Unit
	TC400-15	Mains Filter Module
PSM	TC400-25	Power Supply Module
CFM	TC400-36	Conflict Monitor Module
OPM	TC400-40	4 Group Output Module
LPM	TC400-45	Logic Processor Module
SFM	TC400-50	Special Function Module
SIU	TC400-60	Site Identification Unit
EIM	TC400-65	External Interface Module – 16 Input Channels
SBM	TC400-67	Switch Board Module – 16 Switch
LTP	TC400-70	Loop Termination Panel
LTP	TC400-74	Loop Termination Panel –RTA Style Terminals
FLU	TC400-85	Flasher Unit.
CBC	TC400-95	Cardbus Personality Card
LSU	TC400-145	Light Sensor Unit
GSU	TC400-155	Gas Sensor Unit
SBM	TC400-167	Switch Board Module – 8 Switch
OPM	TC400-240	4 Group NexGen Output Module
VDM	TC408-80	8 Ch Vehicle Detector
VDM	TC416-80	16 Ch Vehicle Detector
BPM	TC408-90	Backplane Module – 8 Signal Groups
BPM	TC416-90	Backplane Module – 16 Signal Groups
BPM	TC424-90	Backplane Module – 24 Signal Groups
BPM	TC432-90	Backplane Module – 32 Signal Groups

Table 25 ATSC4 Module Part Numbers

13 Alternative Cabinet Types

The ATSC4 Traffic Signal Controller is available in two alternative cabinet sizes to the standard full sized ground mounted cabinet.

The S Type cabinet which can be configured for up to 8 Signal Groups, 16 Vehicle Detectors and 16 External Inputs and the P Type cabinet which is typically used for 4 Signal Groups, 8 Vehicle Detectors and 8 External Inputs. Please note that the P Type cabinet can be configured for 8 Signal Groups.

The functional operation and fitment of the S and P Type Cabinets is covered in the generic description of the earlier sections of this document.

The equipment layout and wiring diagrams of the S and P Type cabinets is in the following sub-sections of this section.

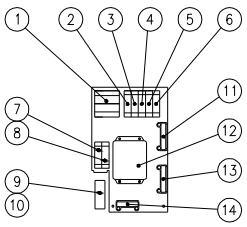
The S Type controller part number is TC488-xxx for an 8 Signal Group controller where the xxx is customer specific.

The S Type controller part number is TC484-xxx for a 4 Signal Group controller where the xxx is customer specific.

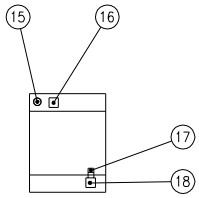
The P Type controller part number is TC494-xxx for a 4 Signal Group controller where the xxx is customer specific.

The P Type controller part number is TC498-xxx for an 8 Signal Group controller where the xxx is customer specific.

13.1 'S' TYPE CABINET



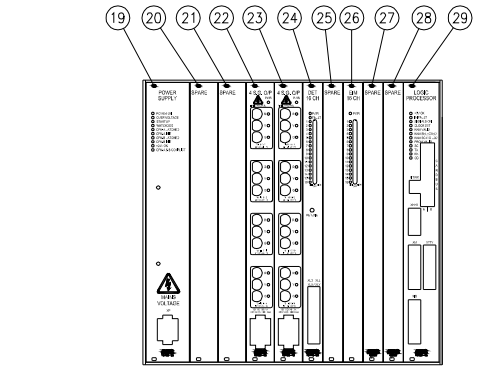
SWITCH BOARD



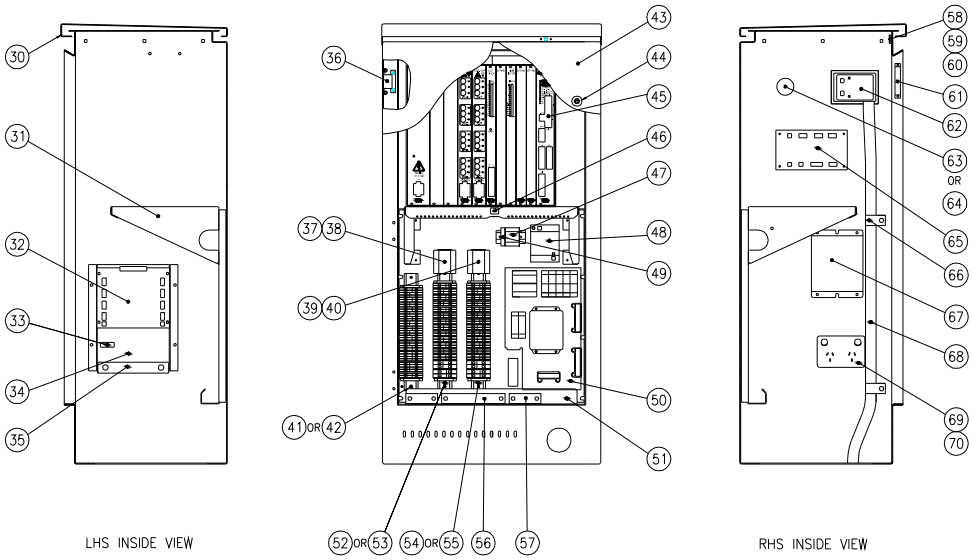
TRANSFORMER 240V – 28V
84VA FUSED

PARTS LISTING

1.	TC400-15	MAIN FILTER CAPACITOR MODULE
2.	PC0123	LAMPS MCB 20A 10KA
3.	PC0122	FLASH MCB 16A 10KA
4.	PC0120	LOGIC MCB 6A 10KA
5.	PC0120	DETECTORS MCB 6A 10KA
6.	PC0120	AUXILIARY MCB 16A 10KA
7.	PC0110	SURGE DIVERTER
8.	PC0104	MAIN MCB 32A 10KA
9.	PF0104	FUSE HOLDER FC32A
10.	PF0105	FUSE NS32A
11.	PL0329	NEUTRAL LINK 12 WAY L12 C/W COVER
12.	PF0107	EMI MAINS FILTER
13.	PL0329	EARTH LINK 12 WAY L12 C/W COVER
14.	PL0329	NEUTRAL LINK 7 WAY L7 C/W COVER
15.	PF0715	FUSE 3.15A M5 X 20 – DELAY TYPE
16.	–	32V WINDING
17.	PS8015	SUPPRESSOR B-22nf 100R (OPTIONAL)
18.	–	240V SUPPLY FOR TRANSFORMER
19.	TC400-25	POWER SUPPLY MODULE
20.	R8095	BLANKING PANEL 4 GROUP OUTPUT MODULE (GROUPS 13-16)
21.	R8095	BLANKING PANEL 4 GROUP OUTPUT MODULE (GROUPS 9-12)
22.	TC400-40	4 GROUP OUTPUT MODULE (GROUPS 5-8)
23.	TC400-40	4 GROUP OUTPUT MODULE (GROUPS 1-4)
24.	–	DETECTOR MODULE
24a	TC404-80	DETECTOR MODULE 4 CHANNEL
24b	TC408-80	DETECTOR MODULE 8 CHANNEL
24c	TC412-80	DETECTOR MODULE 12 CHANNEL
24d	TC416-80	DETECTOR MODULE 16 CHANNEL
25.	R8080	BLANKING PANEL SPARE
26.	–	EXTERNAL INTERFACE MODULE
26a	TC400-65	EXTERNAL INTERFACE MODULE 16 CHANNEL
26b	TC408-65	EXTERNAL INTERFACE MODULE 8 CHANNEL
27.	R8080	BLANKING PANEL SPARE
28.	R8080	BLANKING PANEL SPARE
29.	TC400-45	LOGIC PROCESSOR MODULE
30.	R8805	CONTROLLER CABINET LID
31.	R8850	GEAR TRAY 'S' TYPE CABINET
32.	TC400-79	16 CHANNEL LOOP TERMINAL PANEL
33.	PL0325	EARTH LINK 7 WAY L7A
34.	R8885	16 CHANNEL LOOP TERMINATION MOUNTING PLATE
35.	R7115	FIELD CABLE STRAIN RELIEF
36.	R7017	HINGE
37.	PR0325	F.C.O. RELAY 240V COIL
38.	PR0326	RELAY BASE
39.	PR0325	F.C.O RELAY 240V COIL
40.	PR0326	RELAY BASE
41.		FIELD TERMINAL E BLOCK
42.		FIELD TERMINAL E BLOCK C/W COVER
43.	R8800	DOOR 'S' TYPE CONTROLLER CABINET
44.		DOOR LOCK (TYPE AND KEYED TO ORDER)
45.	TC400-95	PCMCIA CARBUS PERSONALITY CARD
46.		LOGIC RACK RETAINING SCREW
47.	PR0320	MASTER RELAY
48.	PT060B	TRANSFORMER 240-28V 3A (84VA)
49.	PT0342	TERMINAL FUSE
50.		COVER – SWITCH BOARD / FILTER 'S' TYPE
51.		MAIN EARTH STUD
52.	TC416-2	FIELD TERMINAL B BLOCK
53.	TC416-8	FIELD TERMINAL B BLOCK C/W COVER
54.	TC416-2	FIELD TERMINAL A BLOCK
55.	TC416-8	FIELD TERMINAL A BLOCK C/W COVER
56.	R7115	FIELD CABLE STRAIN RELIEF
57.		MAIN EARTH STUD
58.	TC400-175	PHOTO TRANSISTOR MODULE
59.	PP0912	PHOTO TRANSISTOR SPACER
60.	PP0911	PHOTO TRANSISTOR COVER
61.	PS6212	DOOR SWITCH
62.	TC400-10	LINE ISOLATION UNIT
63.	PS2175	FACILITY SWITCH 3 WAY
64.	PS2176	FACILITY SWITCH 5 WAY
65.	TC400-60	SITE ID UNIT
66.	PC2004	CONDUIT SADDLE
67.	TC400-85	FLASHER
68.	PC0111	TELECOM CONDUIT
69.	R8705	GPO MOUNTING BASE
70.	PP0103	GENERAL PURPOSE OUTLET C/W EARTH LEAKAGE



LOGIC RACK



LHS INSIDE VIEW

RHS INSIDE VIEW

ATC Moving Traffic

EQUIPMENT LAYOUT - 'S' TYPE TRAFFIC CONTROLLER

Figure 11 ATSC4 S Type Cabinet Layout Diagram

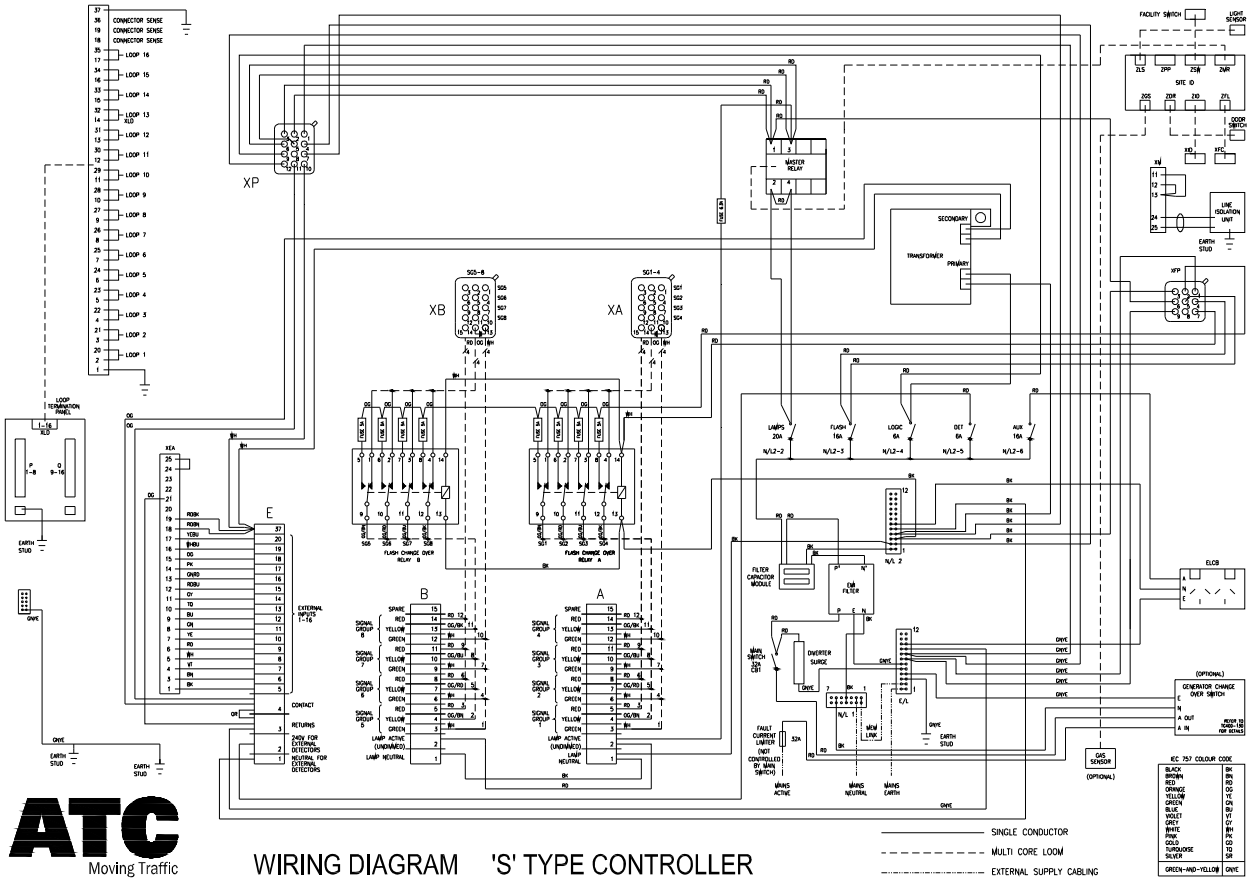


Figure 12 ATSC4 S Type Cabinet Wiring Diagram

13.2 'P' TYPE CABINET

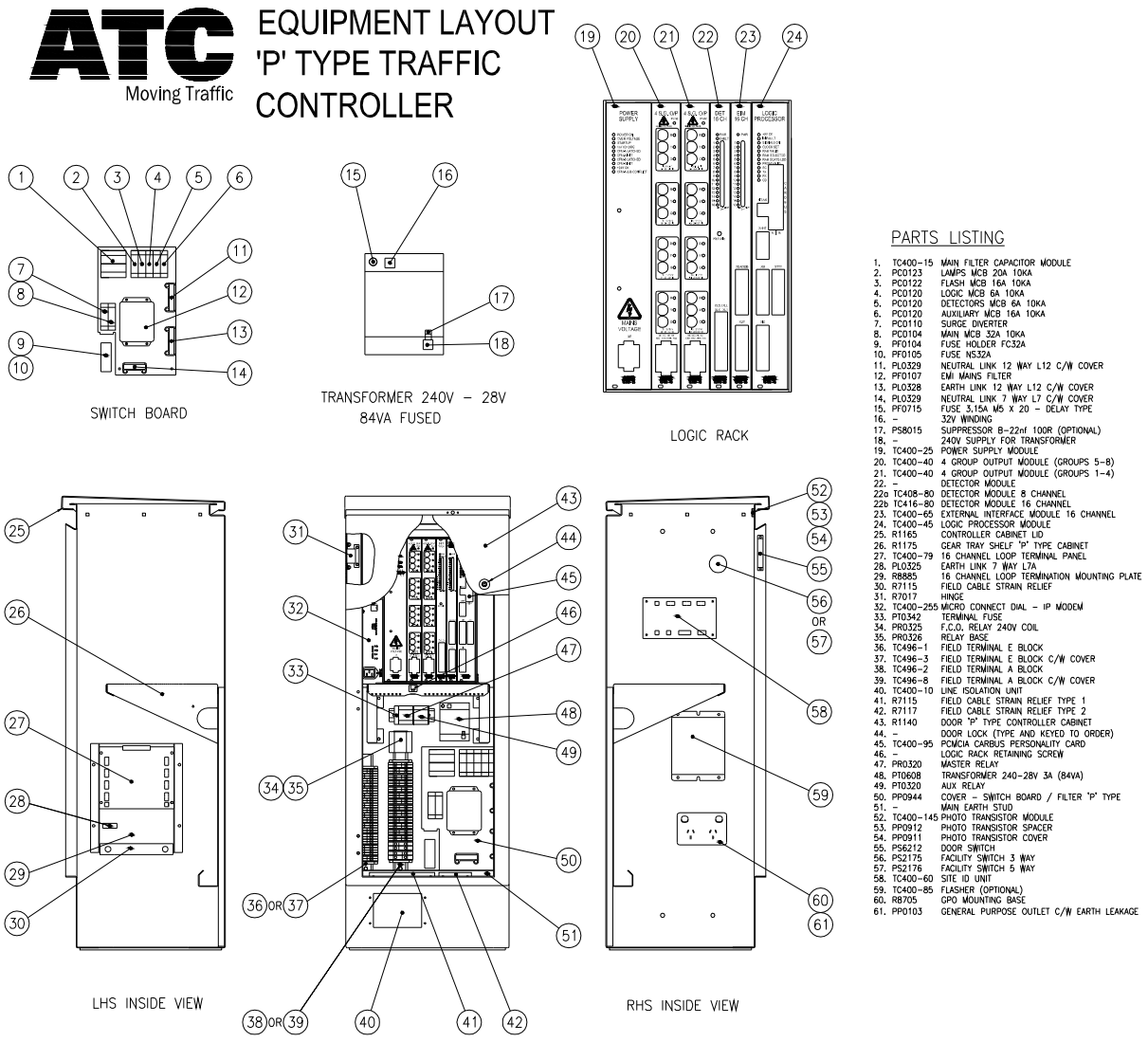


Figure 13 ATSC4 P Type Cabinet Layout Diagram

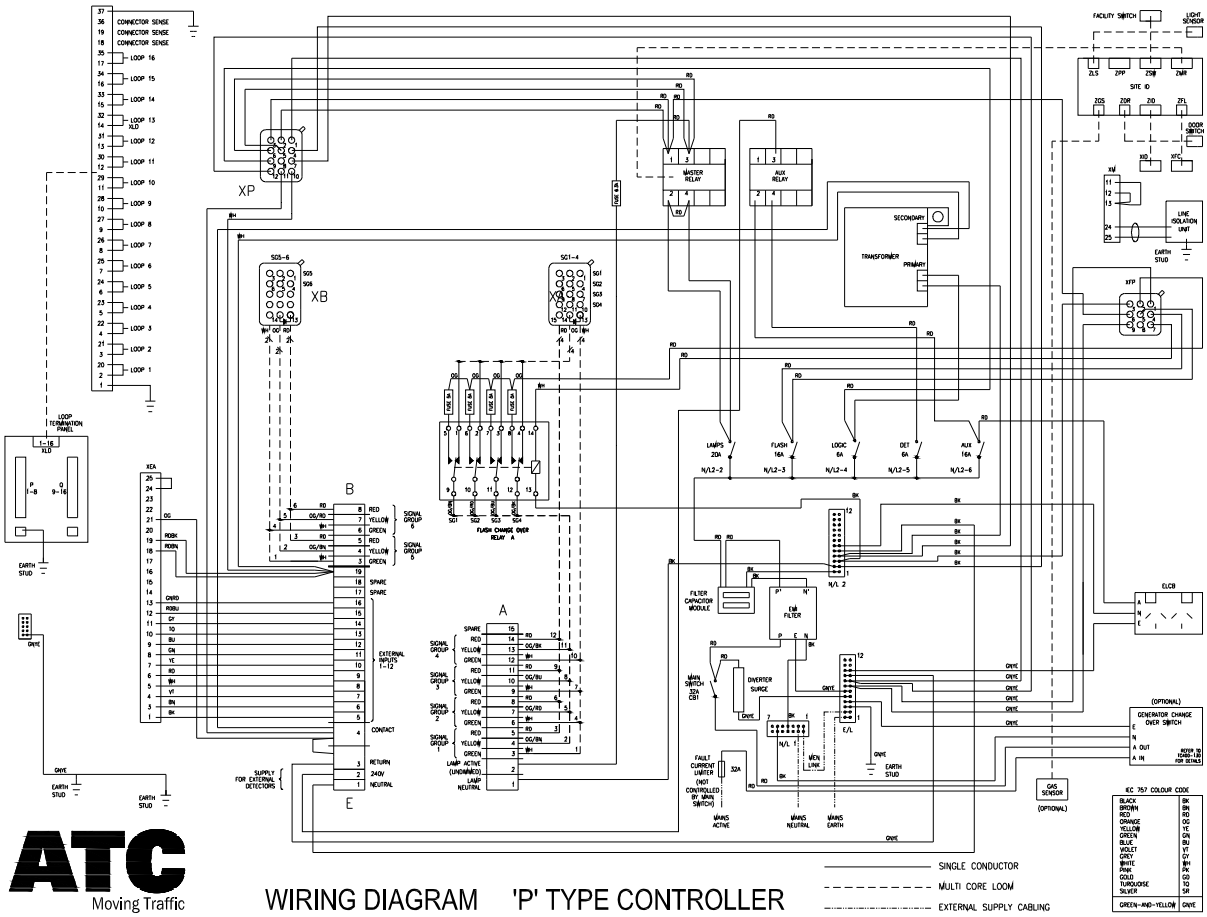
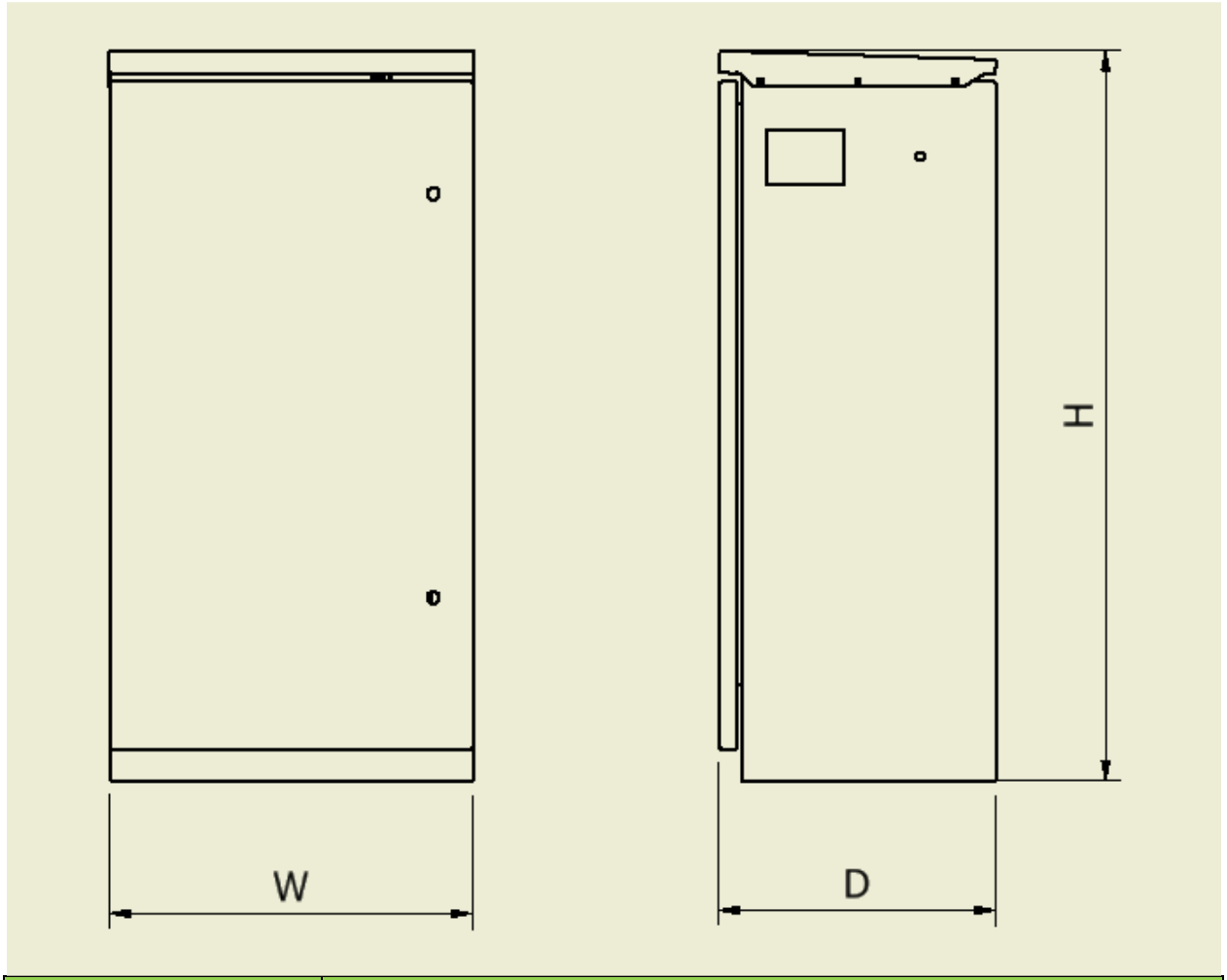


Figure 14 ATSC4 P Type Cabinet Wiring Diagram



CONTROLLER TYPE	DIMENSIONS		
	W	*H*	*D*
STANDARD	800	1380	420
'S' TYPE	550	1110	420
'P' TYPE	400	1115	400

Figure 15 ATSC4 Standard, S and P Type Controller Physical Dimensions

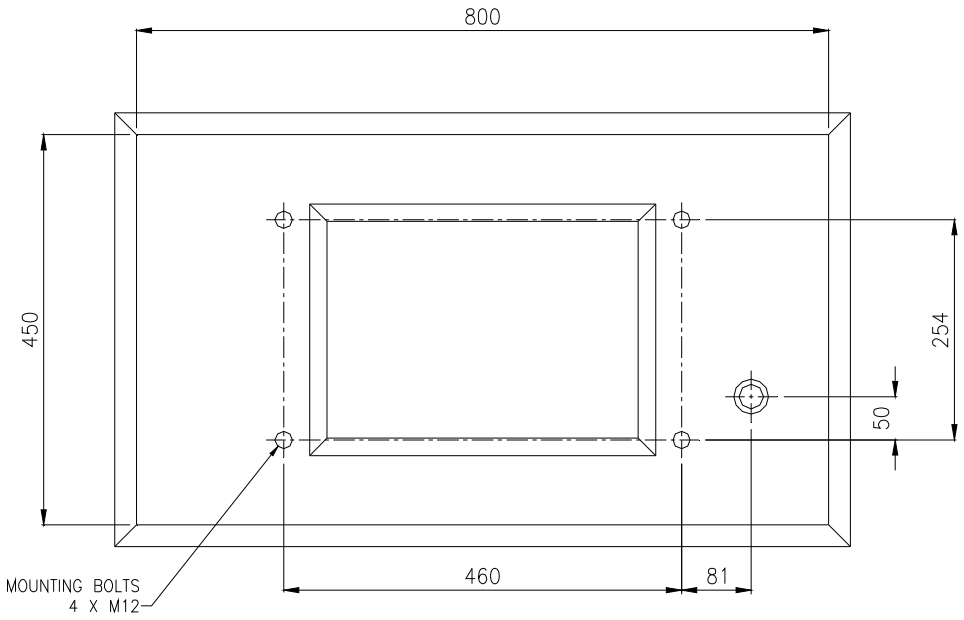


Figure 16 ATSC4 Standard and S Type Mounting Layout Details

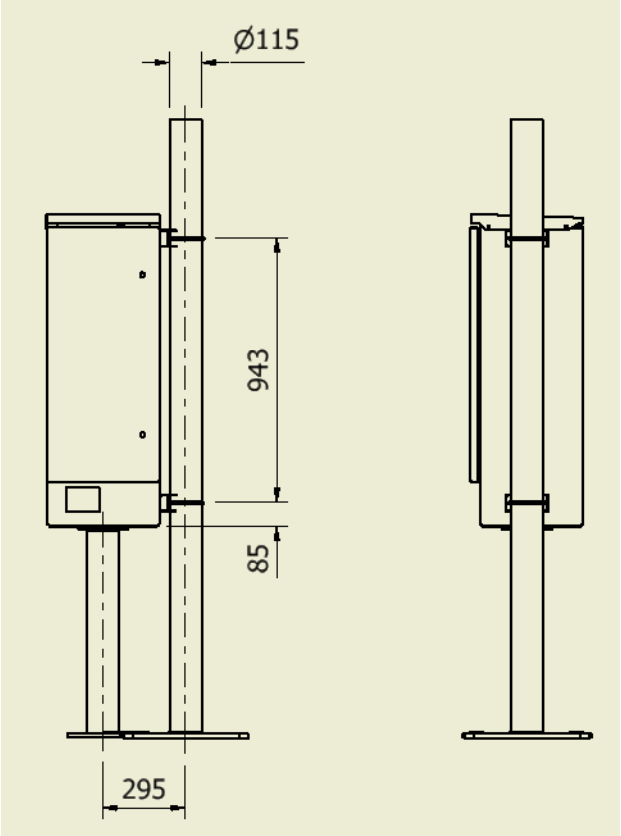


Figure 17 ATSC4 P Type Cabinet Mounting with side post

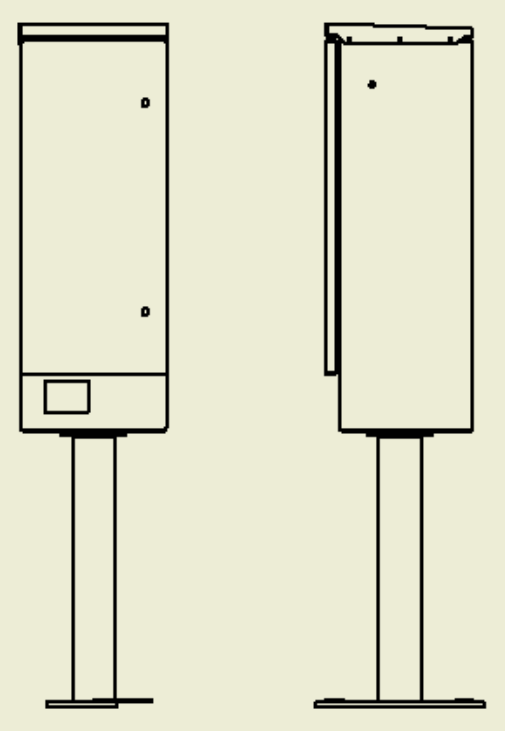


Figure 18 ATSC4 P Type Cabinet Mounting (base mount only)

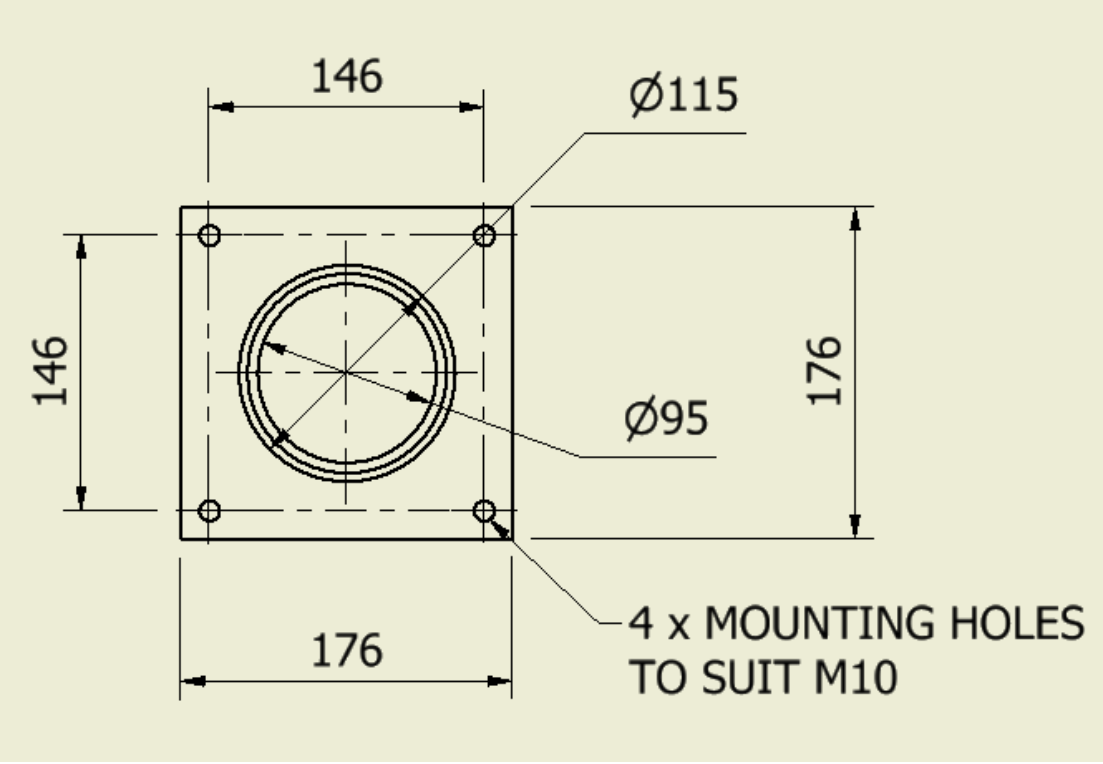


Figure 19 ATSC4 P Type Mounting Plate Details

14 Appendices

14.1 Glossary of Terms and Definitions

AC	Alternating Current
A	Ampere, a unit of current.
BP	Backplane
Byte	8 bit data
°C	Degrees Centigrade
CAN	Controller Area Network
CCB	Closed Circuit Breaker
CD	Compact Disc
CPU	Central Processor Units
DC	Direct Current.
DPR	Dual Port RAM
EEPROM	Electrically Erasable Programmable Read Only Memory
ELV	Extra Low Voltage
Flash	Flash Memory
°F	Degrees Fahrenheit
FCO	Flash Change Over Relay
FIFO	First-In First-Out Memory
GPO	General Purpose Outlet.
HRC	High Rupture Current Fuse.
I	Symbol for Current (Direct or Alternating).
LED	Light Emitting Diode.
LDR	Light Dependent Resistor
LIFO	Last-In First-Out Memory
LTP	Loop Termination Panel
MEN	Multiple Earth Neutral
N/C	Normally Closed.
N/O	Normally Open.
PCB	Printed Circuit Board
PC	Personal Computer
PDA	Personal Digital Assistant
RAM	Random Access Memory
ROM	Read Only Memory
TC	Traffic Controller
V	Voltage, a unit of voltage.
VLL	Voltage to Logic Level
KB	Kilobyte
Kb	Kilobit
MB	Megabyte
Mb	Megabit
GB	Gigabyte
ms	Millisecond
m	Metre (as defined by SI)
Kg	Kilogram
♦SI	System International

This is a list of terms and abbreviations used throughout this document.

♦ Please note that all measurements, units and quantities are in SI units.

14.2 SI Units

14.2.1 Base Units

	SI base unit	
Base quantity	**Name**	**Symbol**
length	meter	m
mass	kilogram	kg
time	second	s
electric current	ampere	A
thermodynamic temperature °	kelvin	K
amount of substance	mole	mol
luminous intensity	candela	Cd
Light output	Lux	L

14.2.2 Unit Prefixes

Factor	Name	Symbol
10^{24}	yotta	Y
10^{21}	zetta	Z
10^{18}	exa	E
10^{15}	peta	P
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{2}	hecto	h
10^{1}	deka	da

° *The unit of Kelvin is defined as -273.15oC and converts to Celsius by: t/°C = T/K - 273.15.*

Factor	Name	Symbol
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p
10^{-15}	femto	f
10^{-18}	atto	a
10^{-21}	zepto	z
10^{-24}	yocto	y

14.2.3 *Prefixes for binary multiples*

Factor	Name	Symbol	Origin	Derivation
2^{10}	kibi	Ki	kilobinary: $(2^{10})^1$	kilo: $(10^3)^1$
2^{20}	mebi	Mi	megabinary: $(2^{10})^2$	mega: $(10^3)^2$
2^{30}	gibi	Gi	gigabinary: $(2^{10})^3$	giga: $(10^3)^3$
2^{40}	tebi	Ti	terabinary: $(2^{10})^4$	tera: $(10^3)^4$
2^{50}	pebi	Pi	petabinary: $(2^{10})^5$	peta: $(10^3)^5$
2^{60}	exbi	Ei	exabinary: $(2^{10})^6$	exa: $(10^3)^6$

Examples and comparisons with SI prefixes

one **kibibit**	1 Kibit = 2^{10} bit = **1024 bit**
one **kilobit**	1 kbit = 10^3 bit = **1000 bit**
one **mebibyte**	1 MiB = 2^{20} B = **1 048 576 B**
one **megabyte**	1 MB = 10^6 B = **1 000 000 B**
one **gibibyte**	1 GiB = 2^{30} B = **1 073 741 824 B**
one **gigabyte**	1 GB = 10^9 B = **1 000 000 000 B**