Traffic Signal Troubleshooting

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What does the Signal Tech really need to know.

Controllers
Conflict Monitors
Battery Back Up Systems
Fiber Optics
Networking and Switches
Adaptive Systems
Central Systems
Preemption
Load Switches
BIU’s
Power Supplies
And Many More
Default CU TS 2
Channel Mapping

Vehicle Phase 1-8

Ped 2
Output Channel 9

Ped 4
Output Channel 10

Ped 6
Output Channel 11

Ped 8
Output Channel 12

Output Channels 1-8

OVL A
Output Channel 13

OVL B
Output Channel 14

OVL C
Output Channel 15

OVL D
Output Channel 16
Sequential Phases in a Ring are not permitted to be on at the same time. In Ring One Phases 1, 2, 3, and 4 should not be programmed to be on at the same time. Same applies to Ring Two for Phases 5, 6, 7, and 8.

Phases that are permitted to be on at the same time will be one from Ring One and the Phase below it in Ring Two or on the diagonal and not crossing the Barrier. Usually Phases 2+6 are Main Street and Phases 4+8 are side street. Phases 1+5 are Main streets turn lanes and Phases 3+7 are side streets turn lanes.

Here is an example of how the turns lanes are defined. Phase 2 turning phase is Phase 5, as you can see the turn lanes are diagonal from the parent phase.
Now we previously learned about a 2 ring NEMA Phasing, the same will apply if we add a 3rd and 4th ring to the cabinet. Seen mainly in TS 2 Cabinets. If used for Vehicle Phasing, Ped and Overlap we will handle a little differently.

Ring Three consist of the following:
Phases 9 through 12 are for Pedestrian Movements

Ring Four consist of the following:
Phases 13 through 16 are for Overlaps A through D

Again we carry over what we learned on permissive phases from Rings 1 and 2. Can not cross the Barrier and sequential phases can not be on at the same time.
Now I will confuse everyone because with Rings 3 and 4 they are slightly different and I will use a new diagram to explain.

Phases 2, 4, 6 and 8 are Parent Phases from Rings 1 and 2 and this diagram shows their Child Phases.

In this Example we show you the new permissive pairs of rings 3 and 4’s Child Phases and how they are associated with the Parent phases of rings 1 and 2.

Phase 2 vehicle + Phase 9 ped + Phase 13 overlap A
Phase 6 vehicle + Phase 11 ped + Phase 15 overlap C
Phase 4 vehicle + Phase 10 ped + Phase 14 overlap B
Phase 8 vehicle + Phase 12 ped + Phase 16 overlap D
Monitor Cheat Sheet & Trouble Shooting Guide

CONFLICT
- Signal Indication Burned Out Shorted or Open
- Field Wiring Output side of load Switch
- shorted Bad transfer Flash relay

RED FAIL
- Bad Load Switch, EPAC, BIU in TS2

CVM/WATCHDOG
- Controller found the fault, Police Flash Switch, TS2 Check Frame Faults

24V-2 & 24V-1
- This is a NON Latching Fault (can be set to latching)
  - The signal will return to normal operation when 24 vdc is restored
  - Power Supply in TS2
  - Controller in TS1
  - Main Power under 90 Volts AC

CLEARANCE FAIL
- If running on Generator bad output power
  - Min Yellow and Red
  - Time was cut short for Yellow or Red Clearance times
  - Controller programming
  - Preemption programming an overlap for right turn signal

PORT 1 FAIL
- TS 2 only faults SDLC Cables, BIU, Controller

DIG/PGM CARD
- Program card ajar, Monitor Broke

FIELD CHECK
- In combination with Conflict helps determine exact signal indication fault

FAIL DUAL
- 2 different Signal indications on at the same time same phase
  - Load Switch Field Wires

INDICATION
- TS 1 (conflict monitor) Green and Yellow Light bulb on at same time
  - TS 2 ONLY a RED out will trigger this with FIELD CHECK Status enabled Bad transfer Flash relay

  LOCAL FLASH Police door Epac incorrect Time of Day

KNOWN GENERATOR PROBLEMS

  - If output power is too high or too low the signal will go in and out of flash
  - If the frequency of the generators sine wave shifts above or below +/- 2 Hertz The MMU and Conflict Monitor will keep the signal in flash
  - RED ENABLE or RED FAIL will be the fault on MMU and RE RE will be on if using the LCD conflict monitors TS-1

  Have the police bring out another generator and write down the number on the generator so we can have it removed from service
Monitor Cheat Sheet & Trouble Shooting Guide

TROUBLE SHOOTING COMPLAINTS from Others/Police  CHECK
POLICE DOOR SWITCHES FIRST
Make sure the FLASH SWITCH is in its proper position

Signal in Flash but I also see the green lit
CHECK Mercury Relay then Flash Transfer relays

**TS 2 ONLY**
Additional info on a TS 2 cabinet not covered in this manual but covered in our other Trouble shooting seminar

PLEASE CHECK THE ALARM PAGES Screens 9-4 & 9-8 & 9-3
USE ECOM SOFTWARE OR EPAC SCREEN 9 – 8 check the MMU ALARM REPORT
This will be able to rule out NON LATCHING FAULTS example loss of 24vdc

START UP FLASH w/PREEMPT
Bad BIU or preempt input
First check screen 1-8 enter frame 138 check bits 22 & 23
Second same as above but check frame 139 check bits 24 thru 27 if a “1” is present the BIU or Preempt card is causing the problem
If replacing the BIU or turning off the Preemption card does not work check that there is no ramp or firehouse or rail road preemption causing this problem remove wires from backboard or unplug “D” connector
LAST replace Controller

TS 2 DIAG FLASH – NO EXIT A series of repetitive faults that require you to power down and recycle power to the signal. These faults happen 3 times in a 24 hour period.

This is caused by a FRAME FAULT check the equipment that is attached to the SDLC cables FRAME  FAULTS 128 thru 131 are all related to the MMU
FRAME FAULTS 138 thru 141 are all related to the TERMINAL & FACILITIES BIU’s FRAME
FAULTS 148 thru 155 are all related to the Detector racks or Camera Processor

In the Seimens Epac Book on page 111 is the Diagnostics section and will explain in detail Also in the book on page 101 is the LOCAL ALARMS explained

**TS 1**
Active status of the intersection
Active status of the ABC connectors output
These 2 screens will show you what color R, Y, G is on for its corresponding phase
When STOP TIME is on because of a fault you can now narrow down what signal colors are giving you a conflict or dual indication
Monitor Cheat Sheet & Trouble Shooting Guide

ON ALL TIMING COMPLAINTS check in this order

TIME OF DAY remember MILITARY TIME is used DETECTORS &

CAMERAS for faults or miss aligned camera
Check Locking Non Locking
Put the phase into MAX RECALL if NO CALL is being generated VERY RARE
Check next paragraph for help on changing vehicle recalls

PHASE DATA make sure it corresponds to the Signal Permit Density times
Pedestrian times Vehicle and Ped Recalls
Phases 2 and 6 are usually are set for MIN RECALL
All other phases are set at No recall unless loop is broken then Max Recall Broken
Pedestrian Button MIN RECALL NEVER MAX RECALL
Max Recall messes up volume density

Protected Turns Phases
Have a dedicated 3 Section head for this movement We want
LOCKING memory

Protected Permissive Turn Phases
Have a 5 section head dedicated for this movement example Phases 1+6
We want NON-LOCKING memory Example the TURNING movement usually phases 1 or 5 and 3 + 7

Side Streets Phases 4 & 8
Non Locking Memory unless Signal plan calls for Locking
No Recalls should be under these phases unless Signal Plan calls for a recall
A logical thought process

7 Step Isolation Procedure

1. Observe intersection operation
2. Identify the problem or problems
3. Determine the general areas that could create the observed symptoms
4. Make tests or take steps to isolate the actual area causing the problem
5. Make tests to determine the device that is causing the problem
6. Replace the defective device or otherwise correct the problem
7. After corrective measures are completed, thoroughly observe intersection operation to ensure that all problems have been corrected.
Define the Problem and Conditions

Flashing Intersection

Controller

Conflict Monitor

Write Down Information

Dual Indication

Two or More Indications Detected on the Same Channel

Isolate Phase at the Field Terminals

Temporarily Load the Field Terminals

Check Load Switch for the Phase

Check Controller Outputs on that Phase

Check for Bad Relay Contact

Check for Debris on Back Side of Panel

Check Cannon Plugs for Debris

Check for Proper Signal Operation

Not Sure

Move Load Switch to a Different Location

No

OK

Replace Controller

Yes

Bad Contacts

Replace Relay

Remove

Clean

Reset Monitor with CAUTION

Field

Cabinet

Check Field Wiring

Check Field Terminals For Contact Between Field Outputs

Look for a Common Point Where Two Indications Meet

OK

Replace Load Switch

Yes

13-17

Yes
Define the Problem and Conditions

Flashing Intersection

Controller

Conflict Monitor

Write Down Information

Conflict

Voltage Detected Concurrently (>450m sec.) on any conflicting channels

Remember the wiring diagram

Is the monitor card programmed?

Program the monitor card

Yes

Reset monitor with CAUTION

Yes

Field

No

Cabinet

Yes

Isolate the conflicting channels / phases at the field terminals

No

Temporarily load the field terminals

Yes

Check Field Wiring

Things to check: Shorted wires, open neutrals, burned out signal lamps

No

Check load switches for a conflicting outputs

Yes

Replace load switch

No

Check for conflicting controller outputs

Yes

Replace Controller

No

Check for bad relay contacts

Yes

Replace Relay

No

Remove Check for debris on the back side of the panel

Yes

Clean Check cannon plugs for debris

No

Yes

Check for Proper Signal Operation

13-20
Display Real-Time Status

Why guess when you can know?

- Real time status shows all signal states, field terminal voltages, and cabinet control voltages.
- Current fault type and fault status is displayed with time and date stamp.
- Channels involved in the fault are directly indicated.

View a display that graphically displays signal On/Off states as well as the RMS voltage at each field terminal and at the AC Line input. It is like having a 48+ channel digital voltmeter connected to the cabinet 24 hours a day, 365 days a year. When a fault is detected the real-time status is latched as a snap-shot of the cabinet status at the time the fault was detected. The fault type is displayed with the time and date of the event. Channels involved with the fault are also directly identified.
MMU acts like 48 individual Volt meters on every signal output
Phases 2 + 6  Normal Operation
Where do Signal Technicians receive training?

New Jersey Section of the IMSA

Passed down training within the Department

Local Signal Suppliers
Troubleshooting Tips

- Always remember, in a TS 2 facility, the CU and the MMU share responsibility in looking for problems, and either may initiate a flash condition if one is detected.

- The following three steps will usually provide enough information to diagnose most problems in a previously working facility
  - Look at the Alarms log
    - Look at the MMU fault log
    - Look at the Ring Status for Rings 1 & 2

- If you are physically at the facility, the indicator LEDs on the MMU and BIUs frequently provide convenient information.

- The CU exerts control over the MMU using the CVM line (Controller Fault Monitor Output). Therefore, the MMU will usually not latch into a fault state for a serious problems first detected by the CU.
If the facility is in relay flash, but the load switch LEDs are lit and not flashing, then the MMU has most likely detected a problem before the CU and is holding the CU in stop time. The MMU may, or may not, be latched at this point, depending on what the problem was. The CU logs should have information about the nature of the problem.
The controller has detected either a non-recoverable TS 2 error, or has had three occurrences of a fault for an individual T&F BIU. This will require a CU reset either by power cycling, or using the 3, 5, 9 screen. The MMU may, or may not, be latched, depending on the specific problem.
Frame 138 is associated with T&F BIU #1, so checking the BIU would be the first reasonable troubleshooting step.
A failure of this magnitude usually indicates an electrical problem with the SDLC bus, or a problem with the CU itself.
The New Tool for the Signal Technician
Traffic Adaptive Signals require knowledge of how to operate a computer and some advanced computer skills.
Future for the Signal Tech
Complex signal repair
The End