Black CAT Outstation Platform

Traffic Monitoring *Unleashed*

Overview

The Black CAT Outstation Platform is the next generation in traffic monitoring and control. The product has been designed to provide maximum flexibility and to help future proof the customer's investment. Its modular design allows new technology to be added, as well as allowing for custom builds to meet each customer's requirements. There are three case formats that cater for both mains power and alternative power sources.

The versatility of the Black CAT makes it suitable for the majority of traffic monitoring and control applications. In its simplest form it can be used as a simple count classifier collecting data for the traffic engineer. It can be used as a system component allowing systems to be created that can act on the information provided to drive traffic signs or even control the traffic flows.

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Data Collection and Reporting

The Outstation can collect multiple types of data simultaneously. The design allows for new data types to be added. The current data types available are:

- *Historical Binned.* This is summarised data type that has to be requested by the user. Three types of data can be recorded, each supporting up to 30 bins. The reporting interval is configurable from 1minute to 60 minutes.
- *Historical VBV.* Each individual vehicle is recorded. The user can select which parameters are recorded, and to what resolution. This is particularly useful when data is being transferred via GSM. This data has to be requested by the user.
- *Real-time Statistics*. This is similar to the Historical Binned except the data is sent to the In-station automatically as well as being logged. The design allows for a reporting offset to avoid all the Outstations attempting to send the data to the In-station at the same time.
- *Real-time VBV.* This is similar to the Historical Binned except that the data is sent to the In-station automatically. It also allows for a reporting offset to be set.

The data is stored internally on an SD card. Initially a 1GB card will be used which can hold up to 100,000,000 vehicles depending upon the sensor array being used.

The data is kept for as long as possible and is only deleted when space is required. Each file has an attribute which specifies if the file has been retrieved or not, and there is a unique flag for each user. The Outstation will delete the oldest retrieved data first, and this decision is based on the master user. This allows the In-station to simply request data and the Outstation decides which files to send.

Real-time data is also stored in files. Each period has a flags that indicates whether it has been successfully received by each In-station.

Sensor Technologies

Multiple sensor types supported, new technologies will be added as they become available. The current sensors supported are:

- Inductive Loop.
- Piezo electric sensor (Axle detection and Weigh-in-motion).
- Kistler WIM sensors.
- Switch I/O, allowing external sensor types to be interfaced to the Outstation.

The Outstation is designed to operate with many different types of sensor arrays. The Outstation allows different sensor arrays to be configured for each lane, allowing the user to pick the arrays that best suit the application on a lane by lane basis. This can reduce the cost of installation, e.g. not fitting WIM sensors in a hard shoulder or fast lane. Arrays can be created using multiple sensor technologies to provide maximum accuracy.
Signature profiling using inductive loops allows for vehicle classification without the need to axle sensors. These sophisticated algorithms provide accurate speed and classification even on long feeders.

- Advanced straddle algorithms provides accurate count data.
- Easy to use WIM calibration system.

Algorithms

The Outstation has a number of built-in algorithms that can be independently enabled or disabled. Quite often multiple algorithms are enabled to give a clearer indication of build up of congestion. The design allows for new algorithms to be easily added, the currently available algorithms are:

- HiOCC. This algorithm is design for incident detection. When a loop detects high occupancy it assumes that an incident has occurred and sends an alert to the In-station.
- Speed Threshold. This algorithm monitors the average speed of a predefined period. If the speed changes to a different band, an alarm is sent to the In-station.
- Flow Threshold. This algorithm monitors the flow of traffic over a predefined period. If the flow changes to a different band an alarm is sent to the In-station.

The CA In-station provides enhanced algorithms. It can collect data from multiple sources and use this information to control VMS's or send data to other systems. It provides a unique technique that allows users to create their own algorithms.

Communications Capabilities

- Multiple communications devices supported, new technologies will be adopted in the future. The currently available options are:
  - Ethernet 10 or 100mb network. This is provided using an RJ45 connection.
  - GSM / GPRS Modem providing wireless connections to the In-station.
  - RS232 interface to allow connection to legacy type equipment.
  - USB connection for communications with our custom Engineer's Terminal software.

- The Outstation can communicate with multiple In-station devices simultaneously, up to 4. The data that is sent to each In-station is configurable, allowing each user to collect the data that they require. This unique feature makes it possible for multiple users to share the same Outstation, making the system very cost effective. The design of the Outstation firmware makes it easy to add new device drivers. The currently supported devices are:
  - CA In-station. The Outstation is responsible for maintaining the connection to the In-station.
  - CA Engineer's Terminal. The Outstation listens for incoming connections.
  - Serco MPC.

- The Outstation can communicate using a number of communications protocols. These include:
  - TCP/IP.
  - UDP/IP.
  - SNMP.
  - HTTP.
  - FTP.
  - CA Serial Protocol.

- When the Outstation is used in larger projects it is important to ensure that all the Outstations are set to the same time. This is best achieved by making an SNTP time server available, or the CA In-station can be used to maintain accurate time within the Outstation.

Case options

The Outstation comes in three case options:

- Compact. This case is battery / solar powered and provides 24 sensor input capabilities.
- MIDI. This is a mains powered device providing 24 sensor inputs.
- 19" Rack. This is a mains powered device supporting up to 64 sensor inputs, though it only supports 32 inputs of any particular sensor type.

Fault Management

The Outstation has a wide range fault monitoring systems. When a fault is detected or cleared, it will alert the In-station. The CA In-station has an extensive fault management system to assist the user in identifying the faults in the system. This system has been developed to speed up fault detection to minimise data loss.

The Outstation detects the following fault conditions:

- Sensor fault / clearance.
- Mains fault / clearance.
- Charger fault / clearance.
- Battery fault / clearance.
- Time faults.
- Changes in the types of data being logged.
- Changes in the types of algorithms being run.
- Internal faults.

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Specifications

Loop Detector Maximum Feeder	300M
Loop Detector Inductance range	40 – 500uH
Loop Detector Frequency Control	50 – 100KHz
Adjustable Threshold	Manual or automatic
Signature Class schemes	EUR6, CA10, DOENI5
Loop inputs supported	32 (MIDI and compact 24).
Axle detection	> 99%
Axle classification Schemes	EUR13,FHWA13,FHWA15
Piezo inputs supported	32 (MIDI and Compact 24)
Kistler inputs supported	32 (MIDI and Compact 24)
Piezo / Kistler Sensitivity control	Manual or automatic
Total sensor inputs supported	64 (MIDI and Compact 24)
Weight error	< 5% (L2wL2w using Kistler sensors)
Switch Input Voltage	3 – 18V.
Switch Output	Open Collector up to 30V.
Analogue Inputs	2
Control Input / Outputs	4
Speed accuracy	+/- 3% at a 95% confidence.
Length accuracy	+/- 5% at a 95% confidence.
Class accuracy	Typically > 95%.
Count accuracy	Typically > 99%.
Ethernet	10 or 100 BASE-T
GSM / GPRS Modem	GPRS Class
USB	Type A (PC) and Type B data storage
Serial	RS232 up to 115200 baud.
IP Protocols	TCP/IP, UDP/IP, HTTP, FTP, SNMP
Time Updates	SNTP or custom protocol.
Simultaneous In-station connections	4
Simultaneous Engineer's Terminal Connections	1 local, 8 Remote.
Data storage	SD, 1GB, Typical 100,000,000 vehicles.
Logging supported	Historical Binned and VBV, Real-time Statistics and VBV.
VBV Data Format	User Selectable.
Speed Logging Resolution	0.1 or 1 kph
Length Logging Resolution	1cm or 10's cm.
Arrival time Resolution	1/1000, 1/100, 1/10 or seconds.
Algorithms supported	HiOCC, Speed and Flow Threshold. Up to 10 bands for Threshold algorithms.
Dimensions	19 " Rack 488(W) x 235(D) x 135mm(H) MIDI Compact
Weight	5.6kg (MIDI and Compact will be less)
Temperature	Formally tested to -25 – 65℃, designed to –40 - 80℃.
Case material	Aluminium housing.
Power supply	90 – 230vac, 47 – 63 Hz, 0.5A
High Performance	ARM7 Processor
Program Space	>90% spare capacity
Application Memory	>50% spare capacity

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Compliance

The design of the equipment was to UK Highways Agency standard TR1100 Issue D, General Specification for Motorway Signs, Signalling and Communications Equipment.

EMC

European Standard

EN 50293: 2000 Electromagnetic compatibility – Road traffic signal systems – Product standard

Applied Standards

EN 55022: 2006
EN 61000-3-2: 2006
EN 61000-3-3/A2: 2005
EN 61000-4-2/A2: 2001
EN 61000-4-3/A1: 2008
EN 61000-4-4: 2004
EN 61000-4-5: 2006
EN 61000-4-6: 2007
EN 61000-4-8: 1993
EN 61000-4-11/A1: 2001
HD 638 S1: 2001

Radio

European Standard

ETSI EN 300 330-2 V:1.3.1: 2006 Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Radio equipment in the frequency range 9 kHz to 25 MHz and Inductive loop systems in the frequency range 9 kHz to 30 MHz; Part 2: Harmonized EN under article 3.2 of the R&TTE Directive

Safety (Low Voltage Directive)

European Standard

EN 60950-1: 2006 Information technology equipment – Satety

Environmental

UK Department of Transport Standard

TR 2130 Issue C Environmental Tests for Motorway Communications Equipment and Portable and Permanent Road Traffic Control Equipment

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