MicroCODE Control (EPP) App

EPP Simulation Tool for GM Strategic Suppliers

June 2023

This document is a user's guide for the new MicroCODE Simulation Tool add-on for the General Motors Error Proofing Platform (EPP) System.

For the latest App information and documentation visit:

https://www.mcode.com

This app is part of our Extensible Error Proofing collection…

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Document Status

This table reflects the current status of this document.

Product Version:	**MicroCODE Control (EPP) v3.0.0a1**
Date Last Updated:	**June 29, 2023**
Last Updated By:	**Tim McGuire**
Author:	**Tim McGuire, MicroCODE Incorporated**
Date Created:	**October 2020**

Document and App Conventions

Throughout the MicroCODE Control (EPP) App and its documentation the following conventions are used….

Live/Online PLC Data

Invalid/Online PLC Data

Old/Offline PLC Data

App or File Data

Read Only Data

Fault / Fatal

Errors: Severe/Destructive

Errors: Controlled/Repaired

Warning

Confirmation

Configuration / Selection

Information

Revision History

This table records the edit history of this document.

Document Version	Date Updated	Revision Author	Description of Changes
v1.0.0 a (1)	20-Oct-2020	**TJM**	Initial creation of MicroCODE Control (EPP) User Guide.
v1.0.0 a (2)	21-Oct-2020	**TJM**	Corrections from Alpha 1 testing at KUKA.
v1.0.1 a (1)	7-Dec-2020	**TJM**	New features to simplify the support of AGVs and Stop Stations (ALS) for the BET Project.
v1.0.1 a (2)	9-Dec-2020	**TJM**	New RESTART feature, display of invalid data to make with debugging issues.
v1.0.1 a (3)	13-Dec-2020	**TJM**	Corrected several issues and added a display of PLC API and APP Version mismatch.
v1.0.2 a (1)	22-Jan-2021	**TJM**	Enhanced support for Stop Stations (ALS, AGV, VAC).
v1.0.2 a (7)	3-Feb-2021	**TJM**	Updated API Configuration procedure and various new features.
v1.0.2 a (8)	6-Feb-2021	**TJM**	New GSIP and TRACE display formats.
v1.0.3 b (1)	9-Feb-2021	**TJM**	Updates to the EPP PLC API and New Features.
v1.0.3 b (2)	16-Feb-2021	**TJM**	Updates for the new EPP “Sub-Assembly Interface (SAI)” Conveyor Interface.
v1.0.3 b (6)	24-Feb-2021	**TJM**	Updates for the reworked FPS Conveyor code in the EPP PLCs.
v2.0.1 b (1)	21-Oct-2021	**TJM**	Commonized the PLC API program and added autoconfiguration from the EPP SQL Database into the PLC.
v2.0.1 b (2)	21-Oct-2021	**TJM**	Corrections during HTI buy-offs.
v2.0.1 b (4)	24-Oct-2021	**TJM**	New Features from support Strategic Suppliers.
v2.0.1 b (8)	27-Oct-2021	**TJM**	Corrections for new AGV PLC Code and “Single-Sided” Track Zones, denoted by “L” or “R” in Operation Number.
v2.0.1 b (9)	11-Nov-2021	**TJM**	Added the display of Task State and SLKS to the Footprint Screen. Added support for the new EPP Conveyor Interface structure.
v2.0.1 b (10-12)	19-Nov-2021	**TJM**	Corrected issues after ESYS, HTI, and KUKA testing.
v2.1.2 a (4)	7-Mar-2023	**TJM**	Corrected issues for display scaling and resolution and updated the App to use .NET 4.8 for Windows 10.
V3.0.0 a (1)	29-Jun-2023	**TJM**	Reverted all Apps to .NET 4.5 for GM compatibility. Fix EPP SQL DB issues, see Release Notes.

October 2020 – June 2023

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Purpose of this Document

This document, **MCX-U01 (Control – EPP – User Guide)**, is the user's guide for the MicroCODE Control Simulation App. It is intended to guide EPP support personnel through the process of configuring a simulation and testing a EPP Error Proofing System in a General Motors Strategic Supplier plant.

Intended Audience

The intended audience of this document is GM Strategic Supplier support personnel who are going to implement, test, and support a GM EPP in a General Motors plant.

Audience Prerequisites

GM EPP support personnel need the following training prior to reading this document:

- Microsoft Windows 10 or higher
- General Motors Error Proofing Platform (EPP) System Training (Advanced)

GM EPP support personnel also need to be familiar with the following GM EPP documents prior to reading this document:

- EPP System Overview
- EPP Test Procedures
- EPP Process Tool Testing

Software Prerequisites

Support personnel need the following laptop environment for this App:

- Microsoft Windows 10
- Microsoft .NET 4.5 or higher
- GEPICS Export Files (EPP Build Data format from GEPICS Coordinator)
- EPP PLC Programs from target GM Facility

Hardware Prerequisites

Support personnel need the following hardware environment for this App:

- Windows 7 or Windows 10 PC
- Spec support for .NET 4+
- Logix 5000 L5x, L6x, L7x

Document Structure

This manual contains the following chapters:

- **Chapter 1** – Introduction to the MicroCODE Control (EPP) App
- **Chapter 2** – Installing MicroCODE Control (EPP) App
- **Chapter 3** – Configuring the Site for Simulation
- **Chapter 4** – Monitoring Production as a Viewer
- **Chapter 5** – Configuring the Simulated Vehicle Orders
- **Chapter 6** – Running System Acceptance Tests (SATs)
- **Chapter 7** – App Shortcuts and Special Features
- **Chapter 8** – Handling App Support and Issue Reporting
- **Appendix A** – The MicroCODE Logix 5000 API Program
- **Appendix B** – Required EPP Patches for the App
- **Appendix C** – Memory and I/O Management in the App

Associated Documents

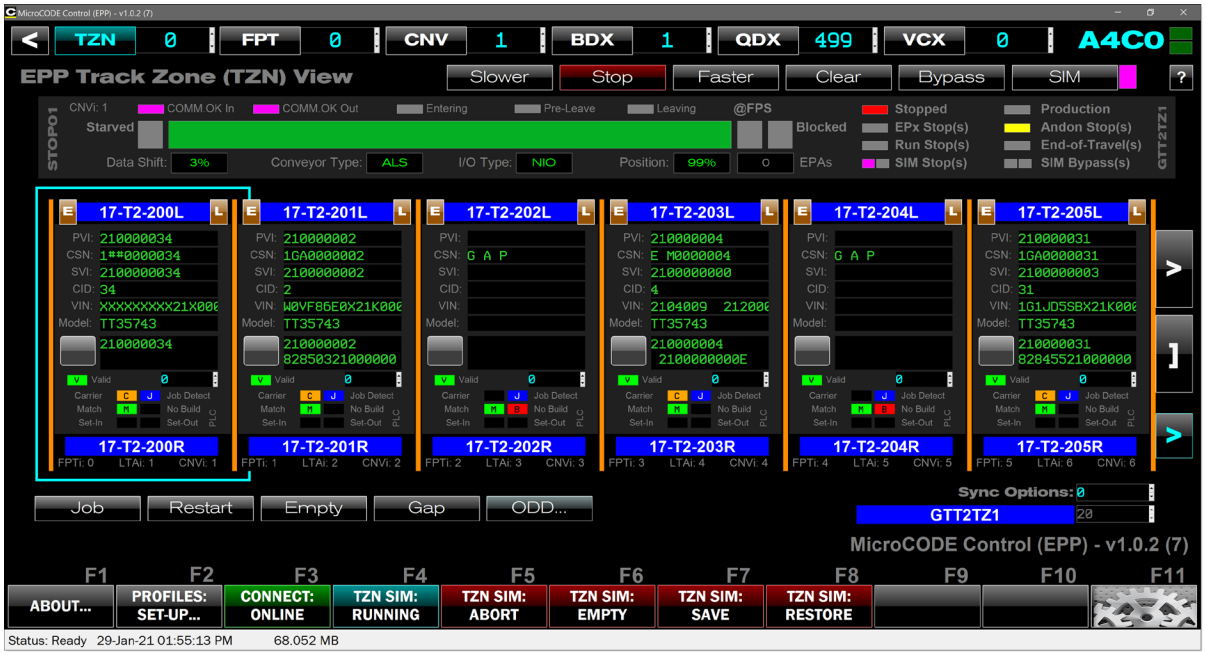
For additional information on EPP Simulations, see the following documents:

- *EPP System Overview*
- *EPP Test Procedures*
- *EPP Process Tool Testing*
- EPP *Simulation Tool User Manual*

1 Introduction to the MicroCODE Control (EPP) App

This app is used to control the generation of simulated GEPICS Jobs (Customer Orders) during System Acceptance Tests (SATs) outside of a normal GM production facility. This app can also control the EPP Conveyor simulation software held within the EPP Cell Controller, without opening the EPP ControlLogix Program. In addition, it allows a user to view the GSIP Defect Queue and GEPICS Trace Data Queue to check the results of any Error Proofing Action test. This allows Strategic Supplier personnel to simulate conveyor movement, Build Data delivery and Error Proofing Actions (TASKs) without having the actual conveyor at the Strategic Supplier's site, enabling them to test Error Proofing Actions and perform System Acceptance Tests (SATs)… all from one App.

Example 1 The MicroCODE Control (EPP) App



This tool is used in connection with several other components:

- EPP Cell Controller (EPP PLCs) – **mandatory**
- Control Laptop (Windows 7 or Windows 10) – **mandatory**
- EPP I/O Networks – **mandatory**
- EPP Error Proofing Stations – **mandatory**

This tool was written with the assumption that the GM IT Systems would **not** be available:

- EPP Web Server – **optional** (but highly recommended)
- GEPICS Server – **optional**
- GSIP Server – **optional**
- GPM&C Server – **optional**

The high-level work process for performing SATs at the Strategic Supplier Sites (SSS) is as follows:

- Configure the new I/O and Error Proofing Actions in the target Plant's environment
- Save the EPP PLCs from the Plant (after configuration download*)
- Take the Logix ACD Files to the SSS and load into Test Area Controller
- Use the MicroCODE Control (EPP) App to generate simulated Vehicle Orders
- Perform SATs of the staged hardware and tooling
- Use the MicroCODE Control (EPP) App to check the generation of GSIP Defects
- Use the MicroCODE Control (EPP) App to check generation of GEPICS Trace Data

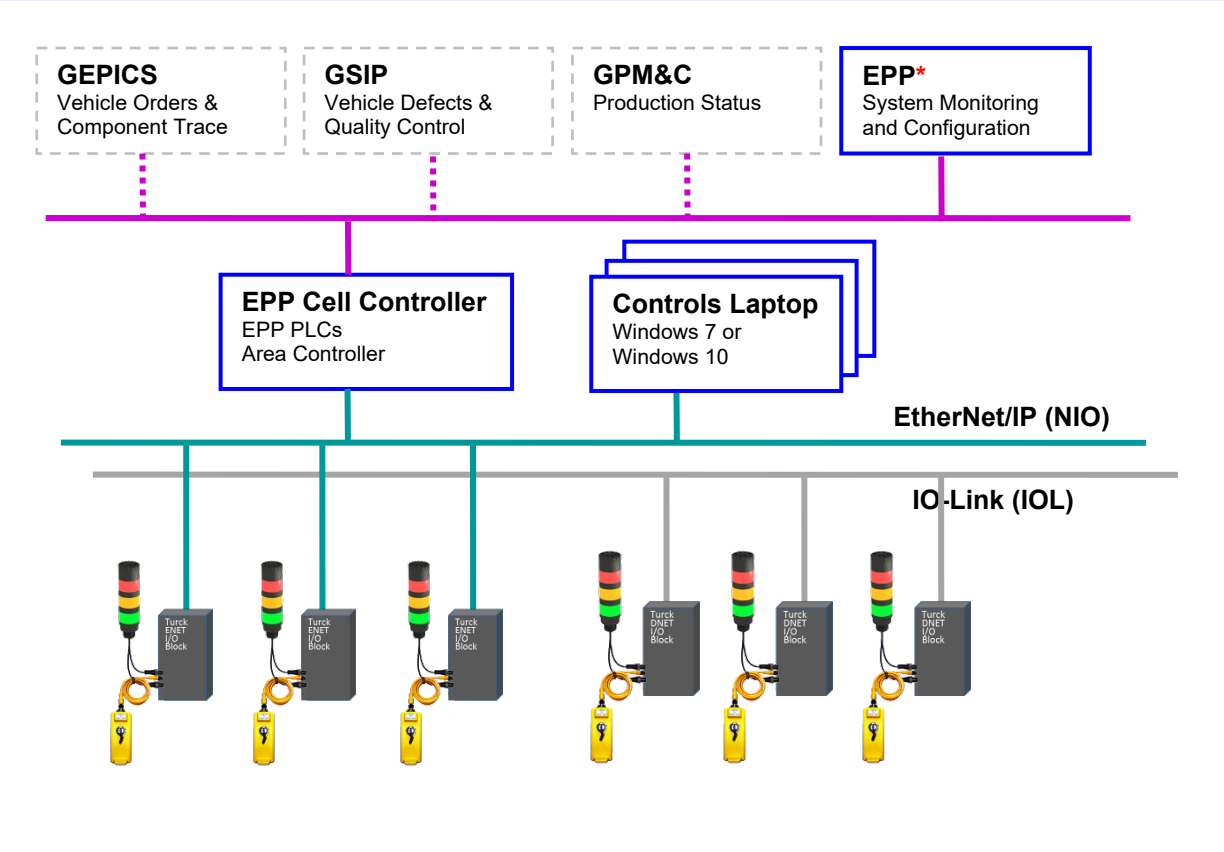
* In order to reserve I/O Nodes addresses in the target GM plant you must go there and configure into their SQL database—thru the EPP Server—all I/O you will be installing. This ensures the plant will not use these same Node address for changes they make while the supplier is staging new equipment at their build shop.

After this I/O is configured, the Supplier must perform a Partial Configuration Download into the EPP PLCs. This must be done to ensure the Plant can continue doing their normal work and will not be caught in a situation where EPP requires a 'Full Configuration Download' which cannot be down while the Plant is running.

Be aware: Any changes to the Production system require start-up support. The Supplier cannot come into the Plant make changes, download them, and walk away.

Figure 1 The GM Strategic Supplier Site (SSS) Environment

The dotted line elements are optional* in the Strategic Supplier Sites, all other components are mandatory. The required Hirschmann (or Cisco) Ethernet switches are not shown.



* The GEPICS, GSIP, and GPM&C Servers are optional because you can use the MicroCODE App to view the queues and buffers used to communicate with these GM IT systems and verify the data *that will be transmitted to the servers in the Plant when installed.*

* An EPP Server (actual or Laptop) is required to view or change any EPP Configuration. So, while the EPP Control App does not need this Server, the User will need this do complete SATs. If the EPP Server is available, the Control App can be auto-configured from the SQL DB on the Server.

If Error Proofing Actions (TASKs) are going to be created or edited at the Strategic Supplier site, they will need an EPP Server with the SQL Database from the target GM Facility. Changes to EPA or I/O Configurations can be performed in the Test site and downloaded to the EPP PLCs. But these changes will have to be documented carefully and reproduced in the GM production facility because there are no import/export tools for EPP SQL configuration at this time.

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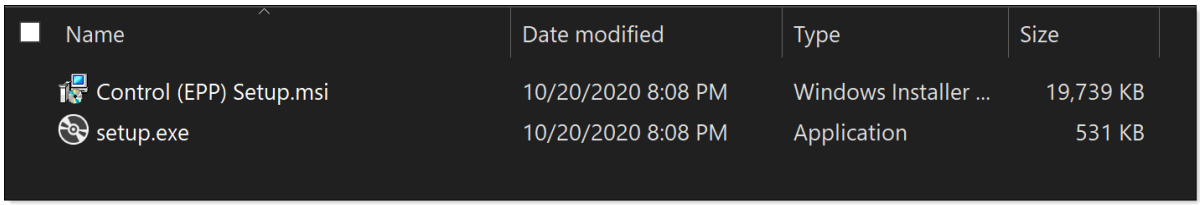
2 Installing MicroCODE Control (EPP) App

The Control App uses a standard Windows install procedure.

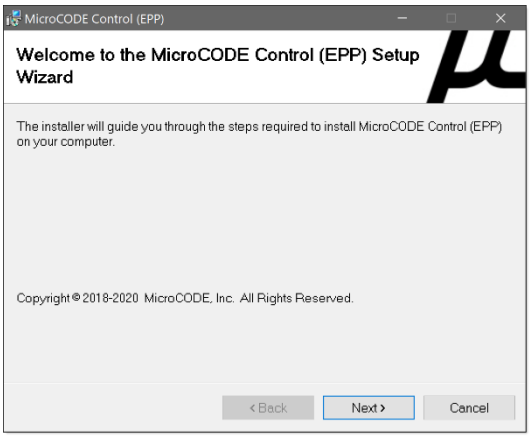
STEP 1: Acquire the Microsoft Installer (.MSI) file for the version you want to install.

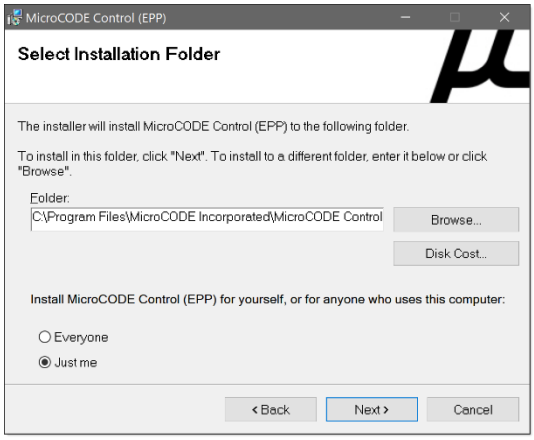
The App installs from a single MSI file that is approximately 10MB in size.
The **setup.exe** file is optional and is not required for an installation.



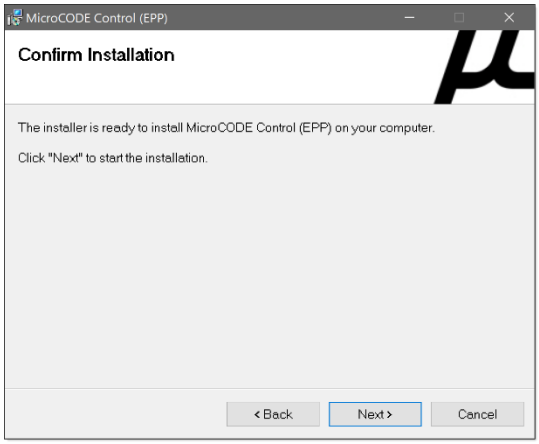
STEP 2: Double-click the .MSI file to start the installation

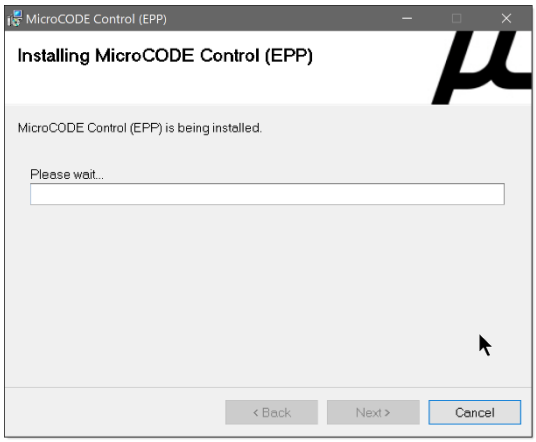
NOTE: If you have a previous version installed its best to uninstall it first. Uninstalling the App does not delete any user configured data (which is held in your 'Documents' folder).

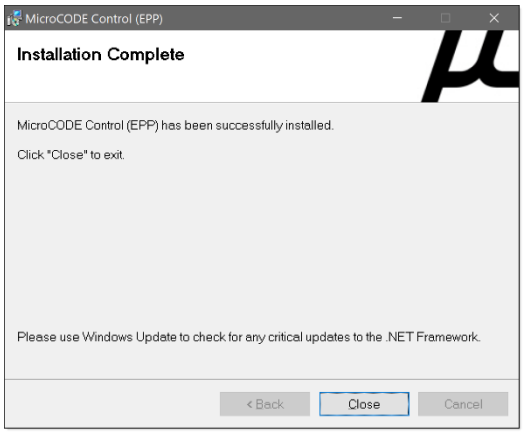




The simplest thing is to just accept all the default install locations…

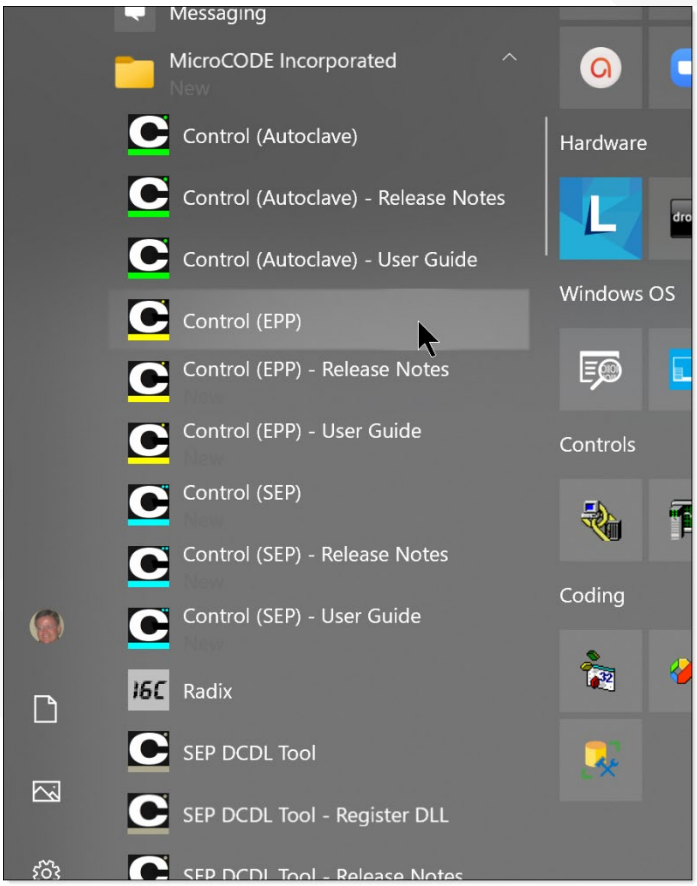




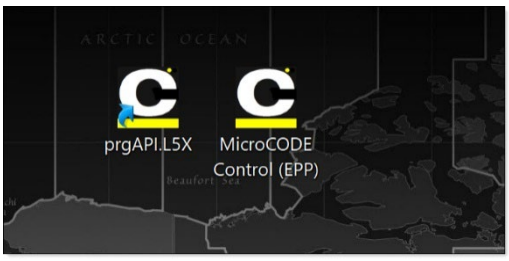


After installation you will have the following:

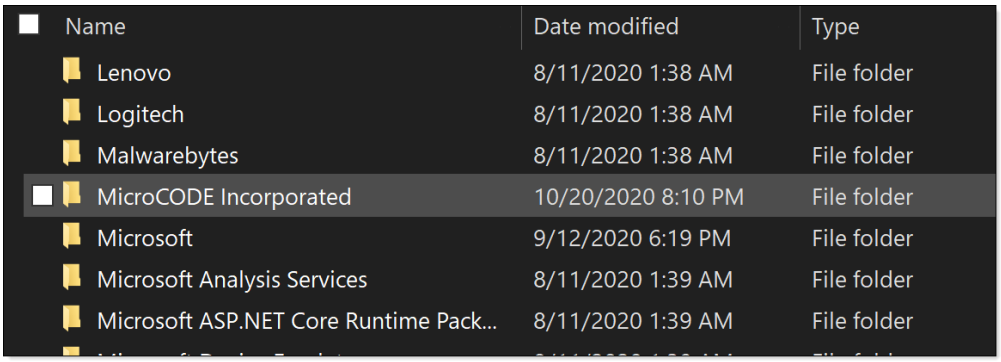
- **START MENU** Shortcuts are created for the App, its Release Notes, and the App's User Guide

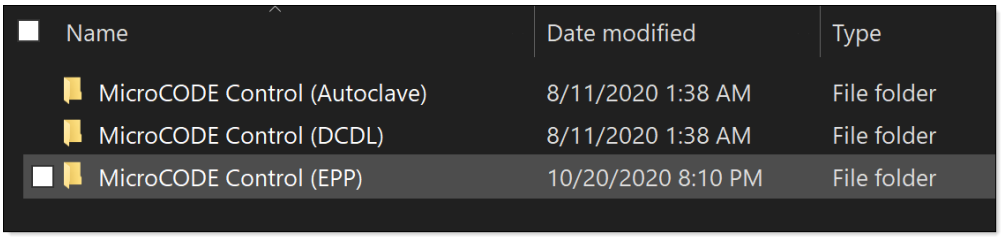


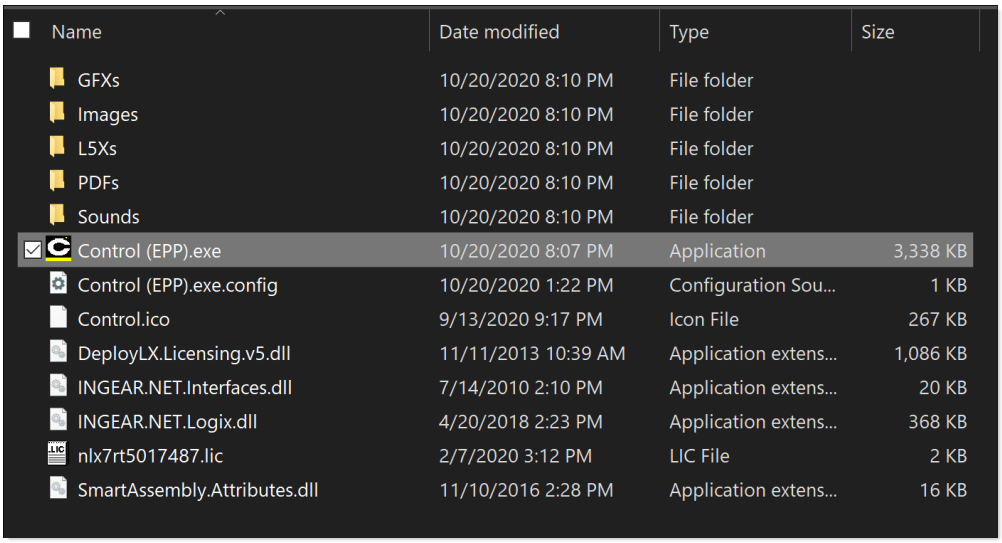
- **DESKTOP** Shortcuts – there two (2): 1) the Windows App, and 2) the importable .L5X file for the Logix 5000 API program needed in the EPP Cell Controller.



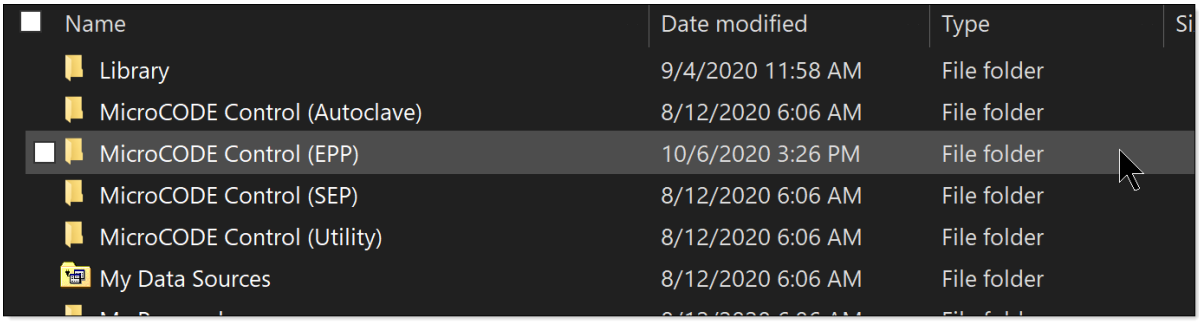
- **Program Files** – App Executable and Data Files

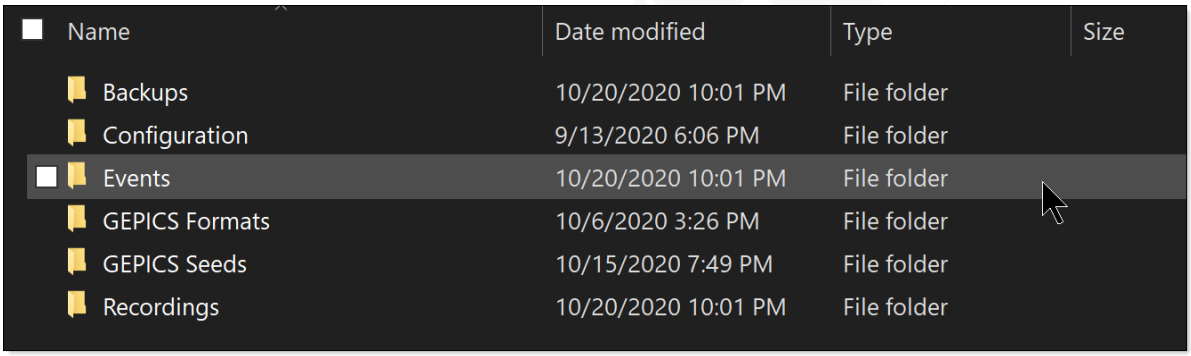






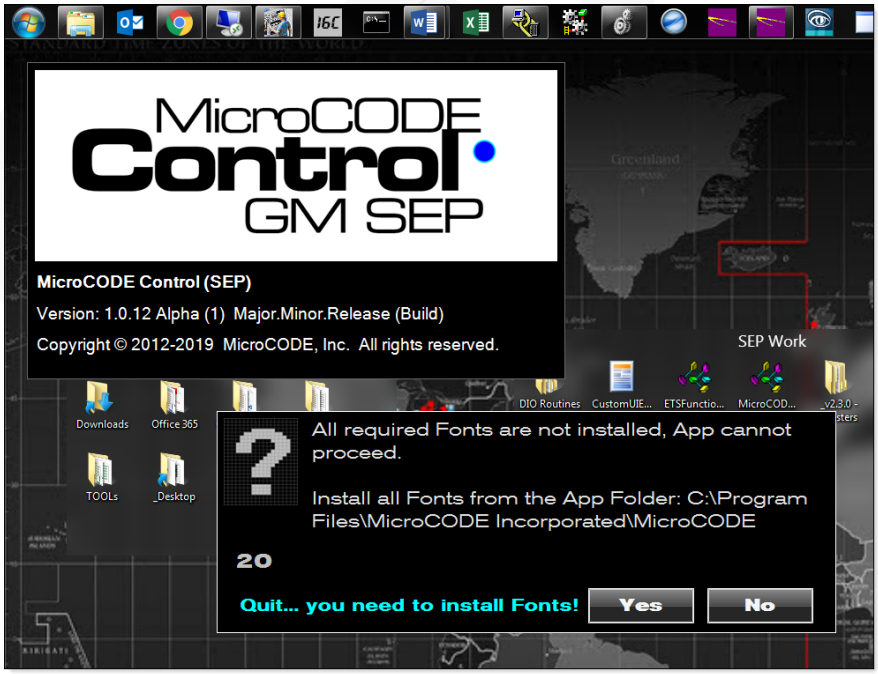
- **Documents** – Your data, Profile Configurations, Event Logs, Seed Jobs, etc.



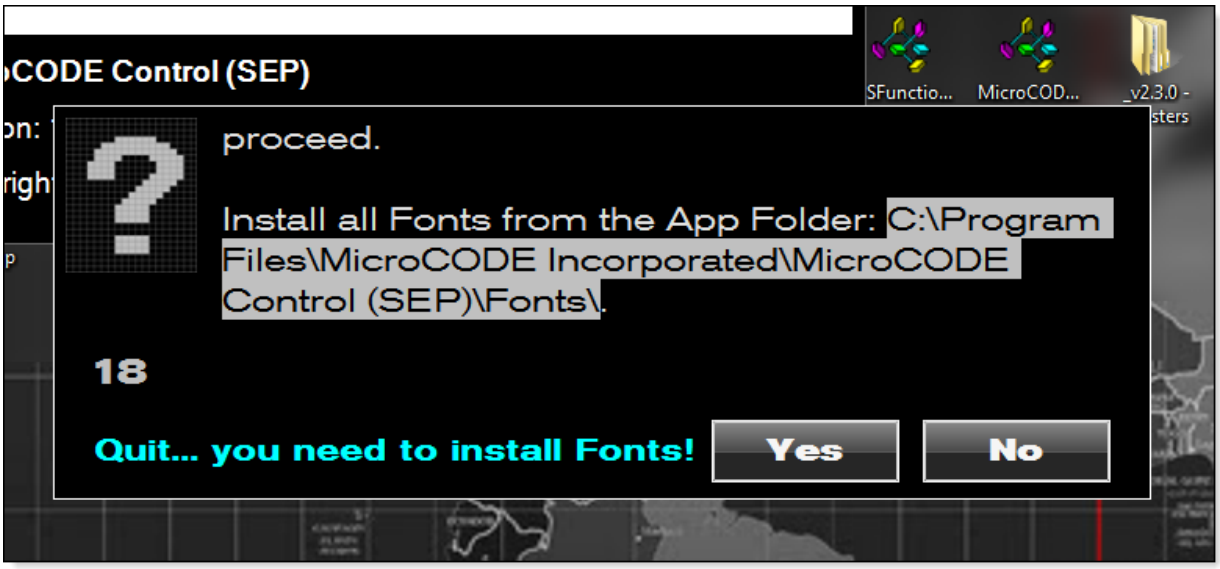


STEP 3: Install the supplied FONTS

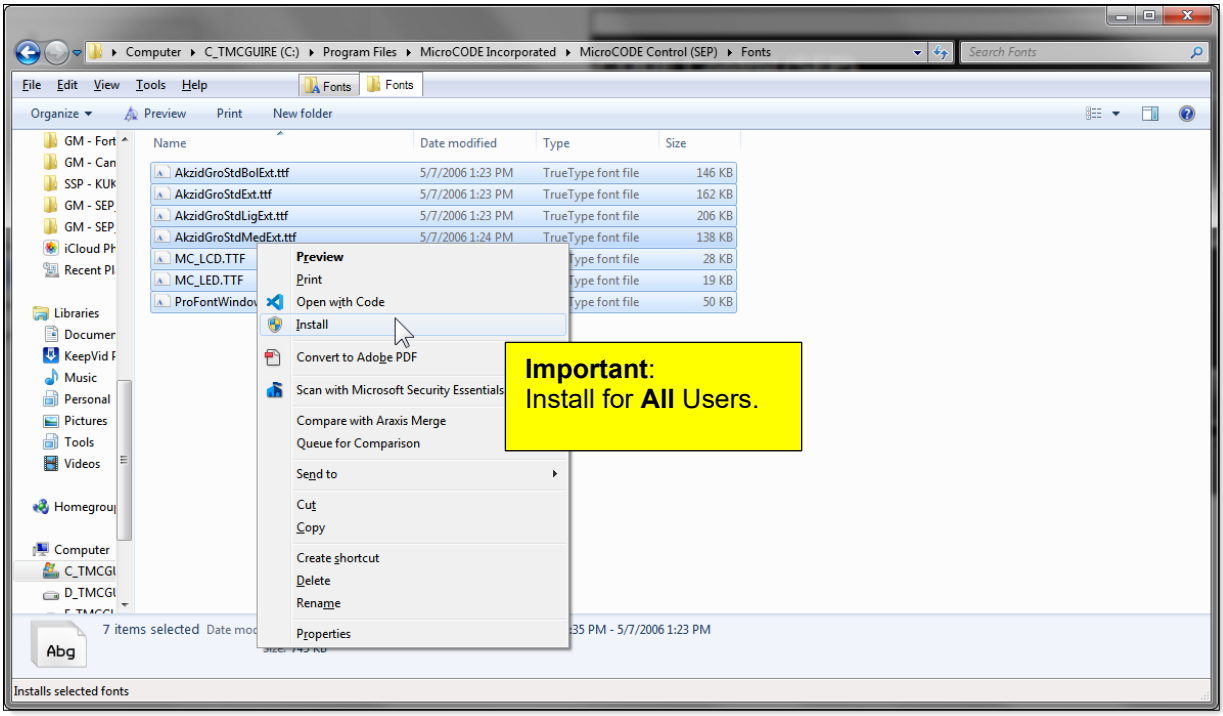
The first time you run the App it checks for a set of **Fonts** it requires for proper operation. If any of them are missing, you will see the following…
NOTE: The "SEP" App is shown below, the "EPP" App is identical.



You can select the **path** to the required Fonts right from the dialog box…
NOTE: The “SEP” App is shown below, the “EPP” App is identical.

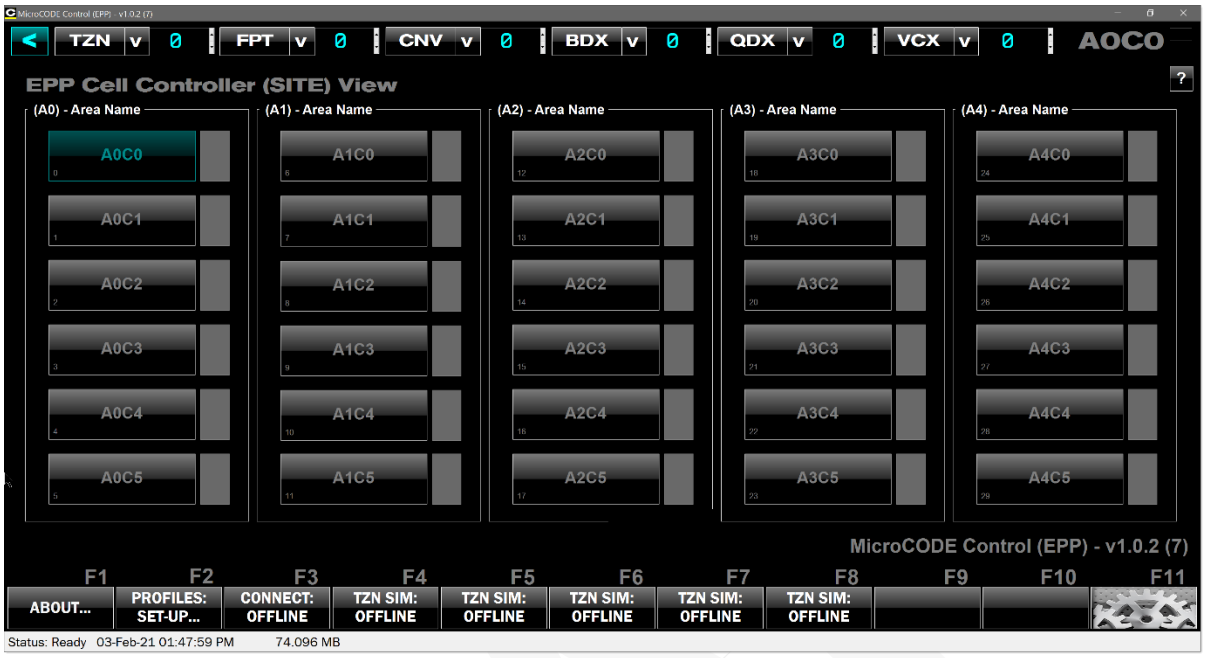


Paste the path into Windows Explorer to get to the supplied Fonts, select them all, right-click, and select **Install… Note: On Windows 10 machines it is necessary to Install for All Users.**



SITE View – All EPP PLCs

The next run of the App will go right to the main App Screen…



That completes the installation. There is nothing else to install.

You do **not** need:

- GE Fanuc – **CIMPLICITY**
- Rockwell Automation – **RSLinx**
- Microsoft – **Office**

Just the MicroCODE Control (EPP) App.

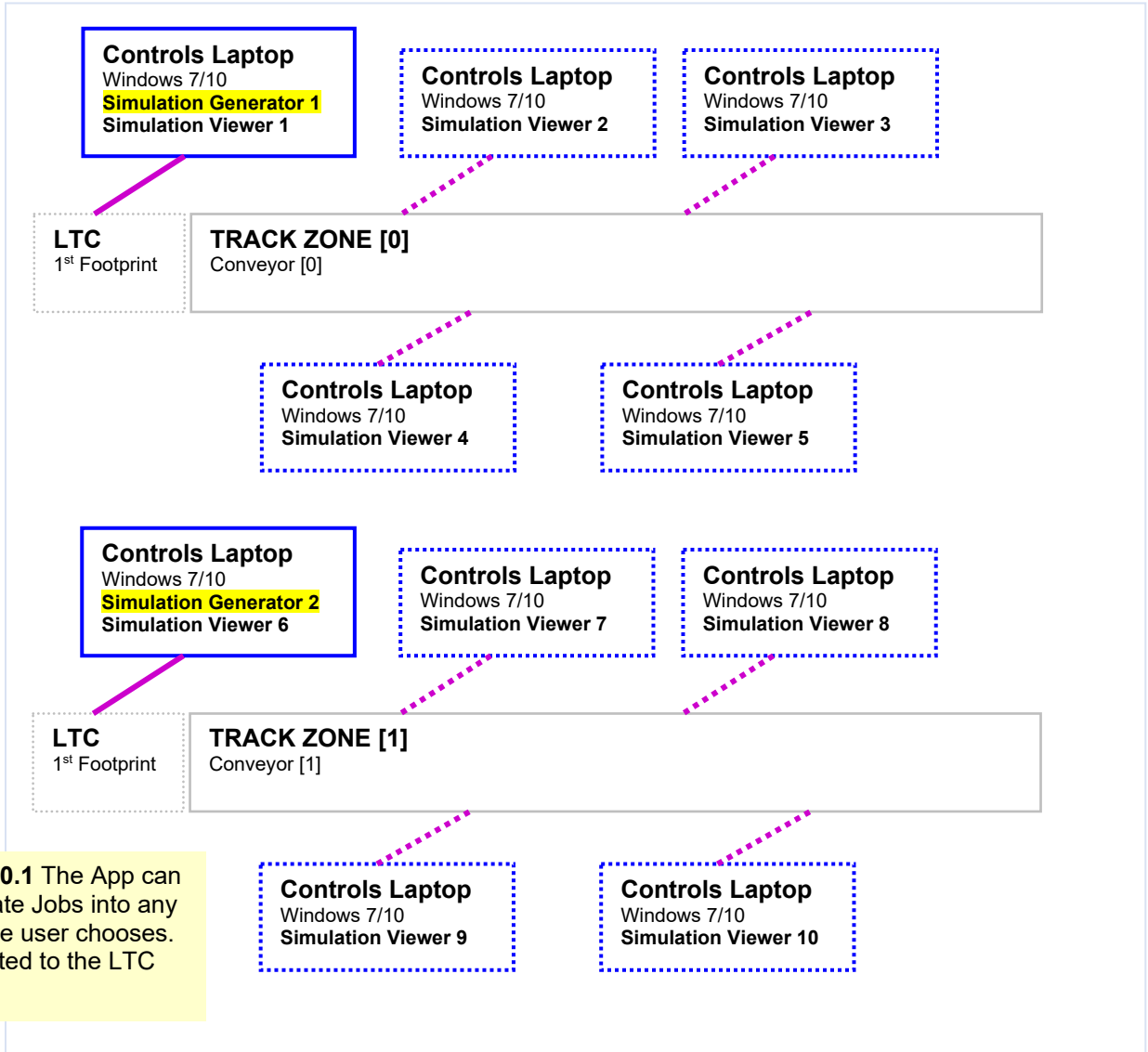
3 Configuring the Site for Simulation

Multiple copies of the MicroCODE Control (EPP) App can be run against the same EPP Cell Controller simultaneously. This allows multiple SAT Teams to work on different Track Zones in the Area.

There is **no limit to the number of 'Viewers'** connected to a Cell Controller in this App, other than load on the associated Ethernet Card(s) in the PLC.

While only one of the Stations can generate simulated GEPICS Jobs for a particular Track Zone, other Viewers of the Track Zone can have their own simulation running from a different client. **The 'Generators' are mandatory and must stay 'connected' to the Cell Controller.** The 'Viewers' can come and go as they please.

Example 2 Multi-user MicroCODE Control (EPP) App Architecture



NEW in **v1.0.1** The App can now generate Jobs into any Footprint the user chooses. It is not limited to the LTC Footprint.

The user can tell if they are the 'Generator' by the "Simulation Owner" indicator at the bottom of the screen.

NOTE: This indicator is only visible when a Simulation is running in the EPP Cell Controller.

GENERATOR:

NEW in **v1.0.1** The App can now generate Jobs into any Footprint the user chooses. It is not limited to the LTC Footprint.

Because of this new capability the concept of a **'Simulation Owner'** has been deprecated. Any App user can generate GAPs, EMPTY CARRIERs, and JOBs into any Footprint they choose at any time that a Simulation has been started—by anyone—in the EPP Controller.

VIEWER:

Any 'Viewer' can take over the Simulation but aborting the current Simulation and starting a new one…

- On the Viewer—or current Generator—press [F6] TZN SIM: ABORT
- On the Viewer (the new Generator), press [F5] TZN SIM: START

A Station is configured for a specific EPP Cell Controller in the **SETTINGS** dialog box.

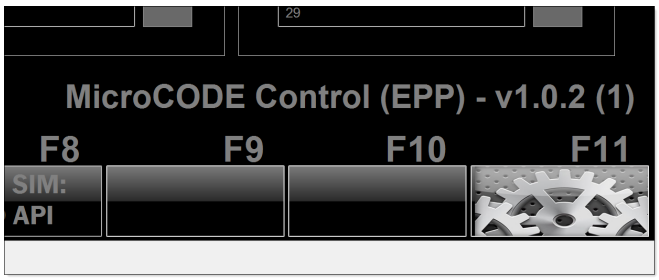
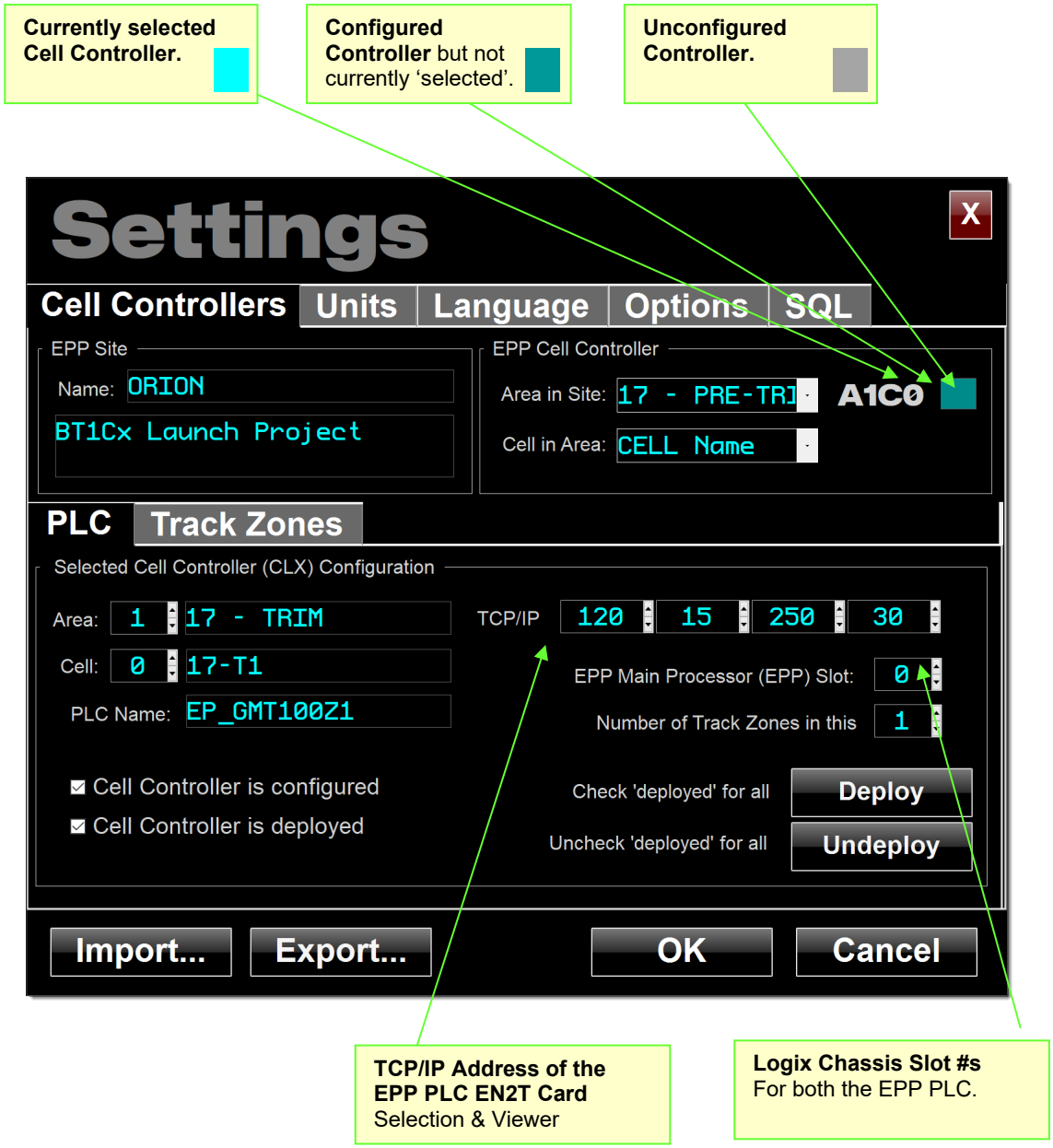
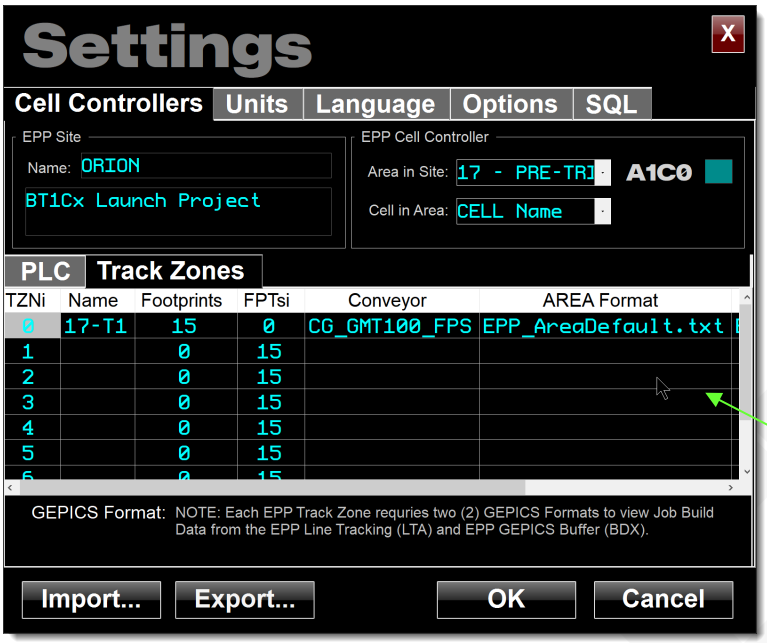


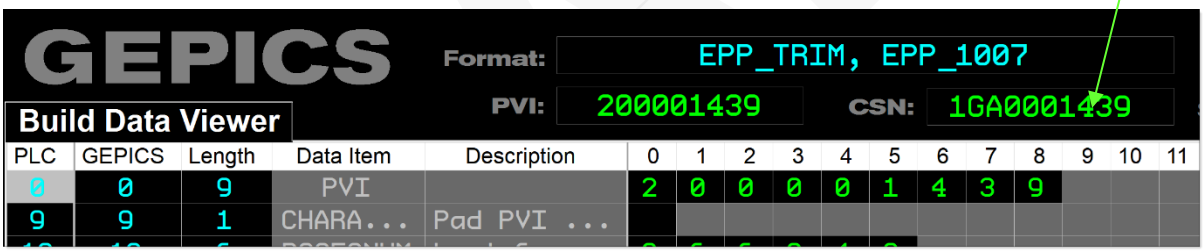
Figure 2 SETTINGS: EPP Cell Controller Tab





GEPICS Formats for this Cell Controller Selection & Viewer, AREA and ZONE

Whenever you open a Job's GEPIC Build Data it will be viewed through these GEPICS Formats, concatenated together. You can change to any other Format you have available 'on-the-fly' by using "Import" in the GEPICS Viewer.



However, this does not change the default you selected in the Settings Dialog box.
If you want to change your default, you must return to this dialog box and import a different Format.

Figure 3 SETTINGS: Units Tab

Imperial / Metric support is a standard feature of the MicroCODE Control Apps, but is not required for SEP.

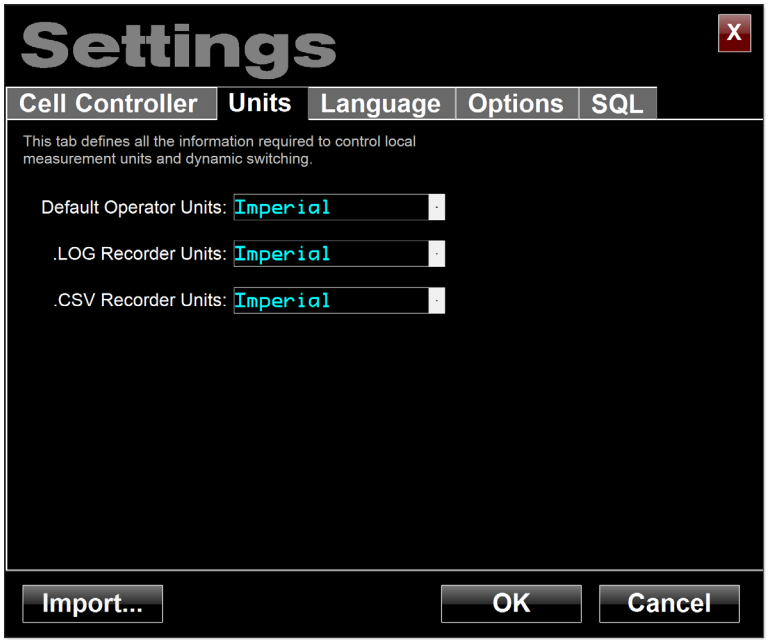


Figure 4 SETTINGS: Language Tab

Multi-Language support is a standard feature of the MicroCODE Control Apps, but is not implemented in this EPP App, the App is locked in English mode.

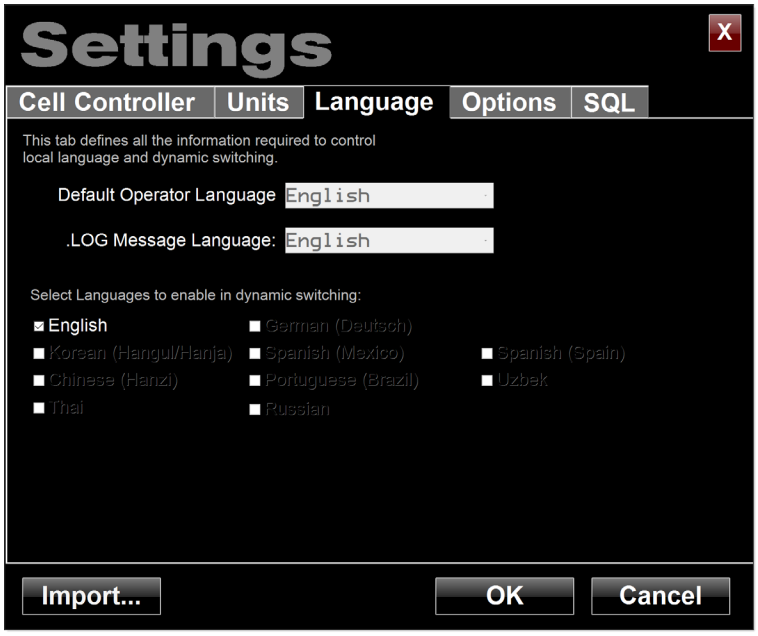


Figure 5 SETTINGS: Options Tab

Data file control is a standard feature of the MicroCODE Control Apps, simply set your own retention rules.

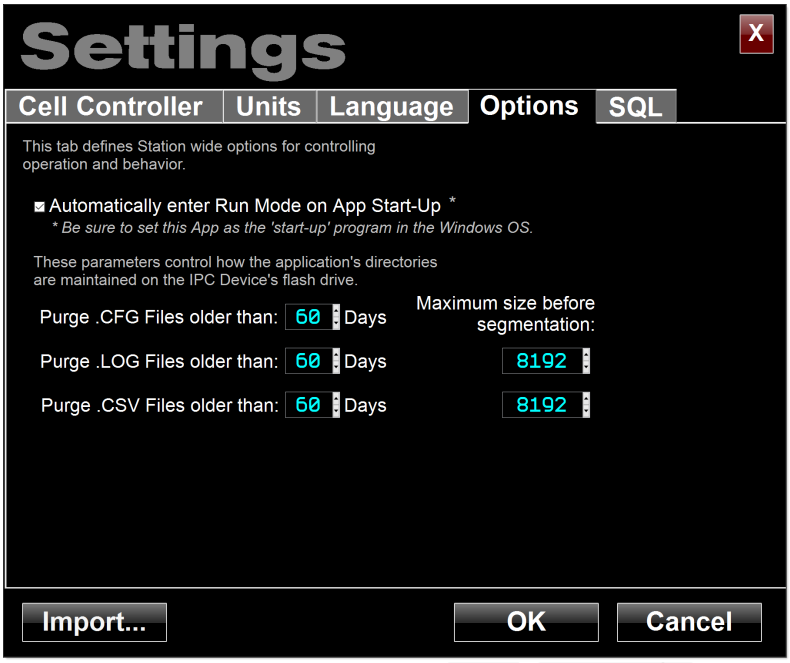
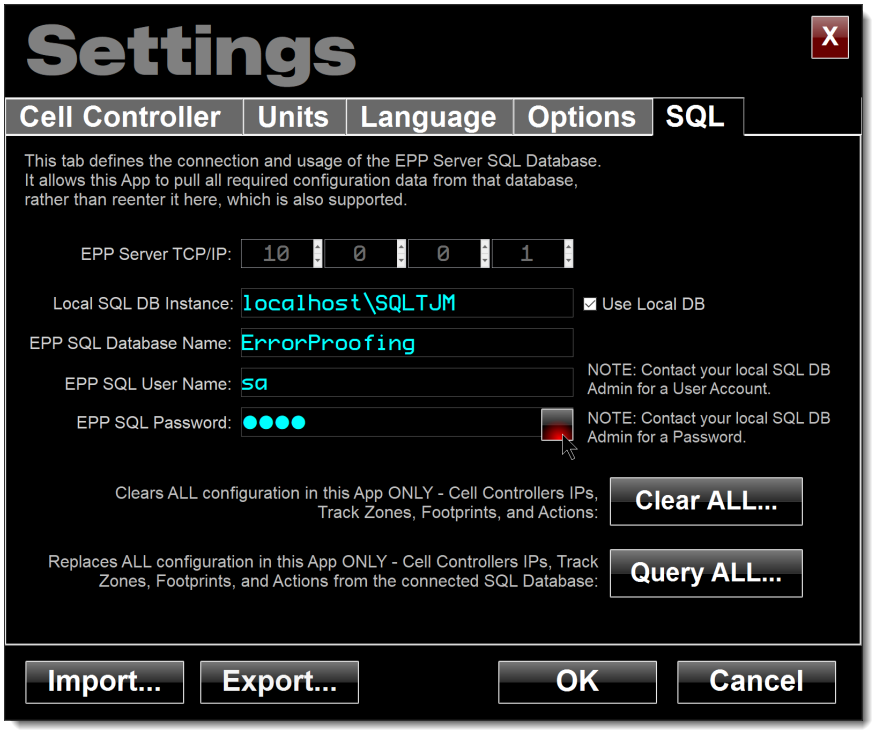
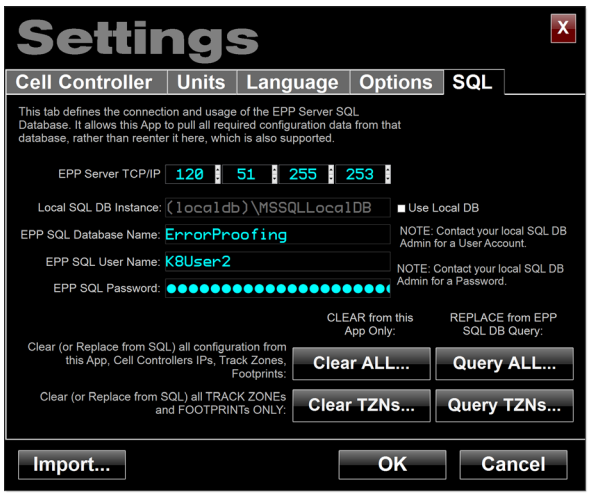


Figure 6 SETTINGS: SQL Tab

The Control App is capable of connecting to an existing EPP SQL Database and auto-configuring itself to match the Site.



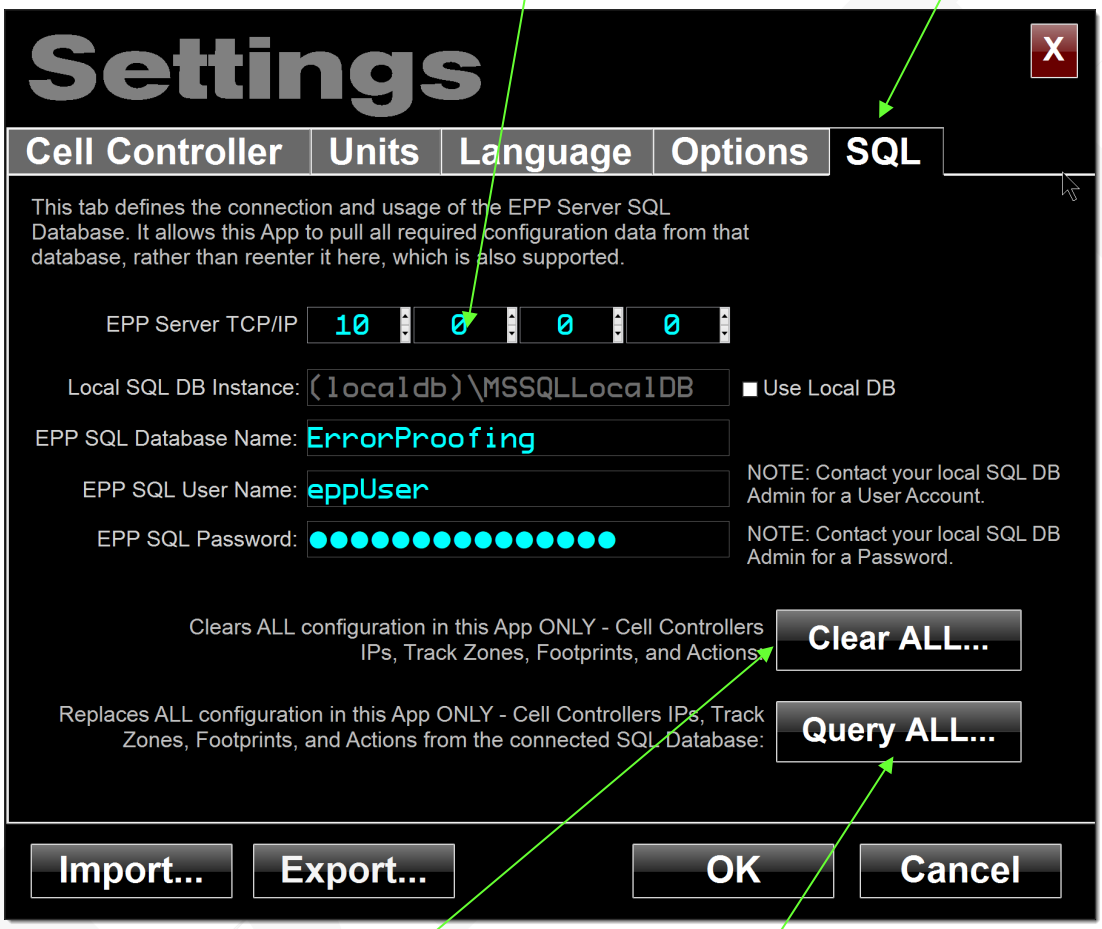
NOTE: The command to clear and query only the Track Zones has been removed starting in v2.1. it was an unnecessary complication. It was originally there to increase App speed but importing all the EPP configuration only takes seconds. Removed in v2.1.



In addition to being able to pull the configuration of all Cell Controllers—for communication—the App now extracts Track Zone and Footprint (DSOA) names from the EPP SQL DB.

EPP SQL Server
New in v1.0, configures READ-ONLY access to the SQL Configuration Database. The Username and Password of this account are fixed by GM IT.

SQL Configuration
New in v1.0, users can now pull all required configuration from a GM Site's EPP SQL Database.



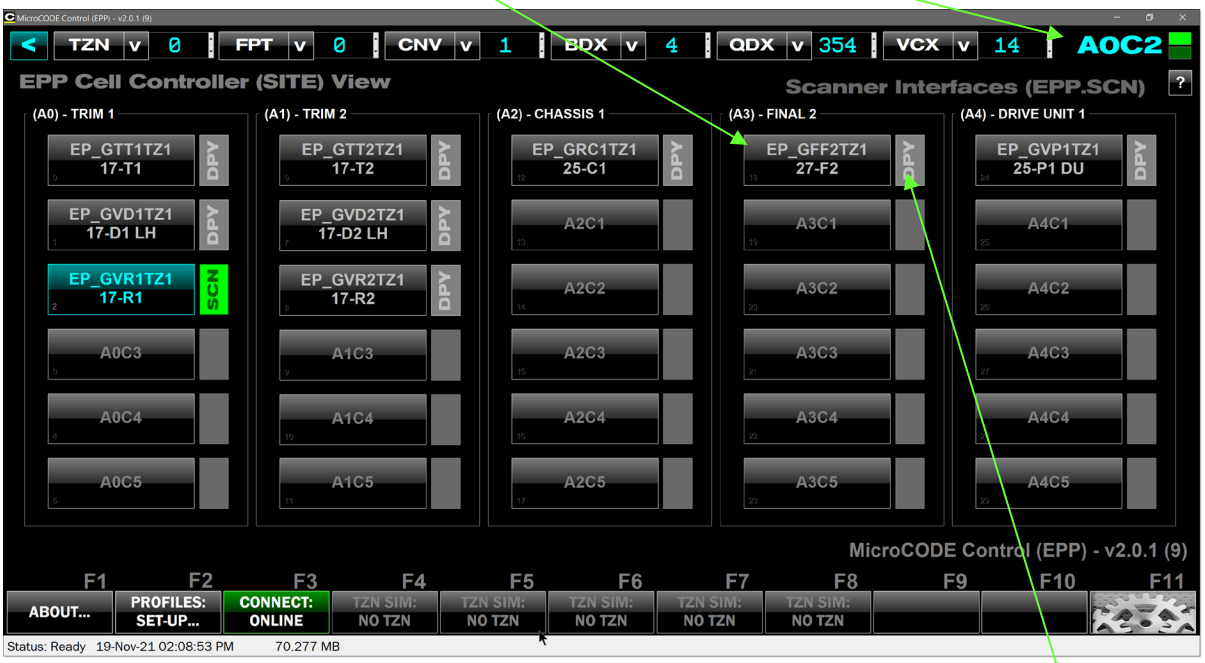
Erase All Configuration
New in v1.0, clears all EPP configuration within the Control App, it has no effect on the EPP SQL Database.

Get All Configuration
New in v1.0, pulls all required EPP configuration from the EPP SQL Database into the Control App.

SITE View – All EPP PLCs

After the SQL extraction the App's SITE View is populated with all the EPP PLCs defined in the SEPP "ErrorProofing" database.

Active Cell Controller
New in v1.0, the Active Cell Controller is always displayed in the upper right, this is the only Controller that can be written to by the App. It is changed by simply clicking on a different Controller in the SITE View shown here.

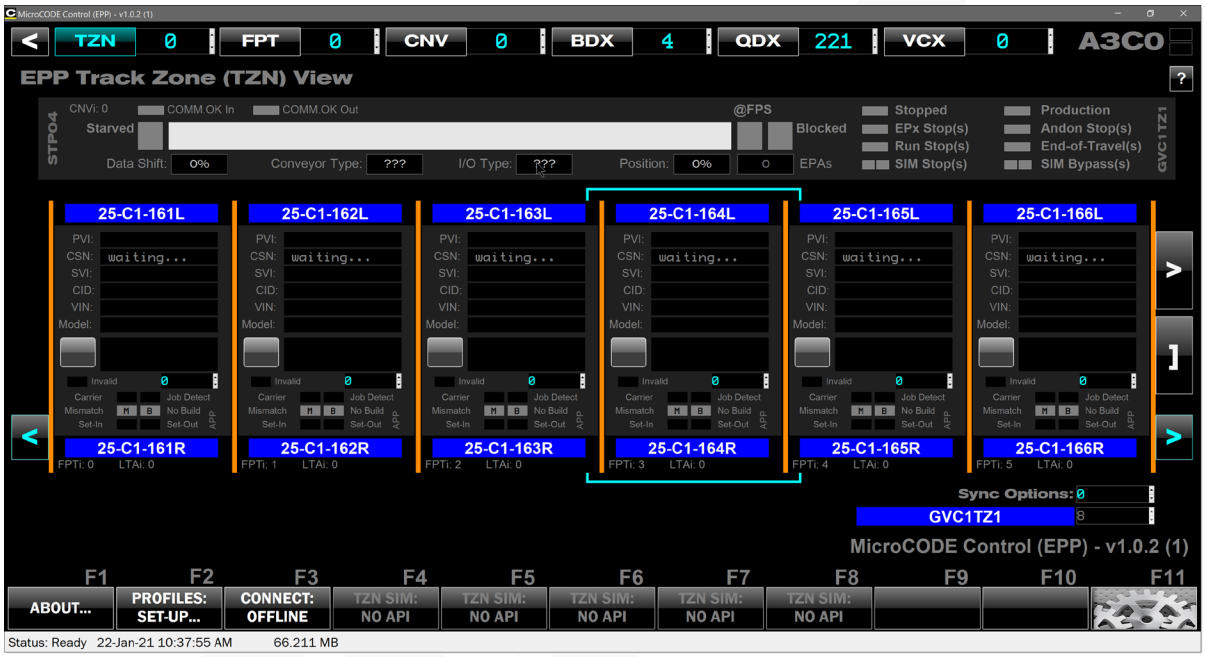


Cell (PLC) Diagnostics Indicator. This shows a rotating indicator summarizing the state of all interfaces in the PLC.

The SQL Extraction allows the App to automatically display the DSOA Placards names with no user input and handles ‘custom’ DSOAs that do not follow the standard pattern.

- If the Track Zone configuration has been extracted into the App the Footprint Placards from the EPP SQL Database are used.

- If the SQL Database has not been queried, then the starting Placard—configured in this App—is used to generate all Placards for the Track Zone.

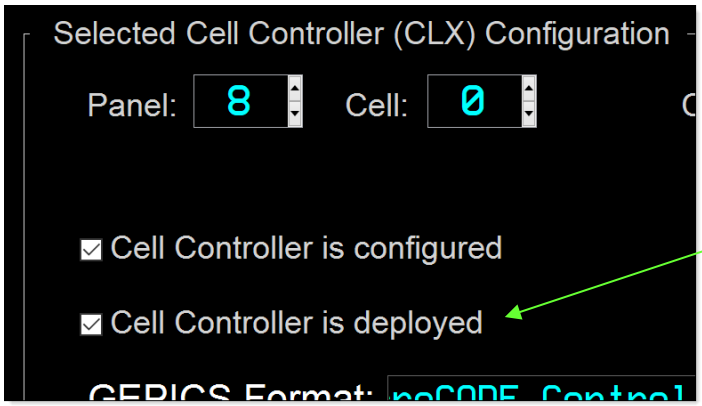


4 Monitoring Production as a Viewer

The MicroCODE Control (EPP) App can be used as a 'Viewer' to monitor an EPP Cell Controller – without the risk of entering simulation.

Starting with v2.0.0 the App can now act as an EPP Site Monitor.

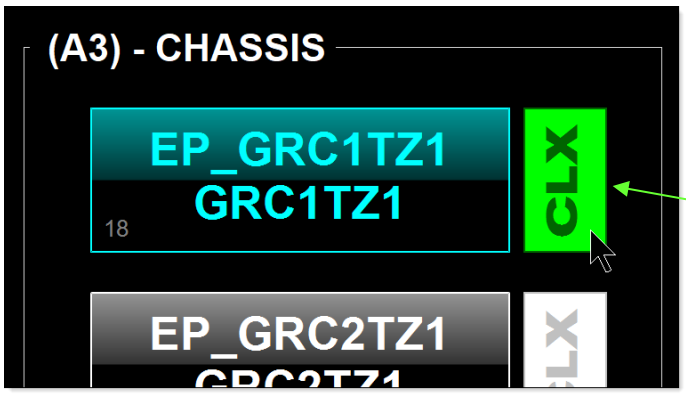
When you CONNECT the App to the Site it establishes a READ ONLY connection to every EPP Cell Controller in your configuration that is marked "Configured" and "Deployed".



NOTE #1: If there are any Cells your do not want the App to connect to simply uncheck 'Deployed'.

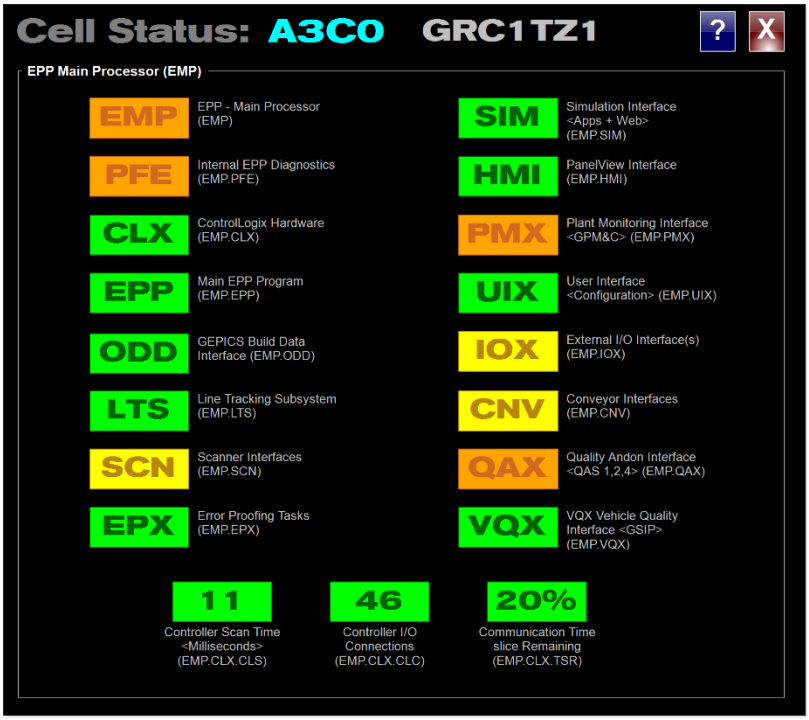
NOTE #2: The initial settings of 'Configured' and 'Deployed' are taken from the EPP SQL Database.

Once connected all the Cell Controllers have their diagnostics available in the App. This is displayed in a rotating indicator to the right of the Cell Controller button.

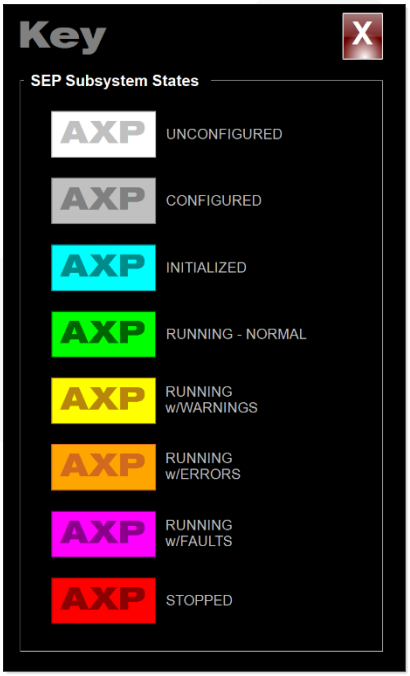


Cell (PLC) Diagnostics Indicator. This shows a rotating indicator summarizing the state of all interfaces in the PLC.

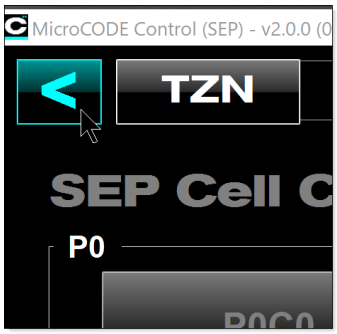
Clicking on the 'Diagnostics Indicator' open a complete view into the Controller showing all Subsystems summaries…



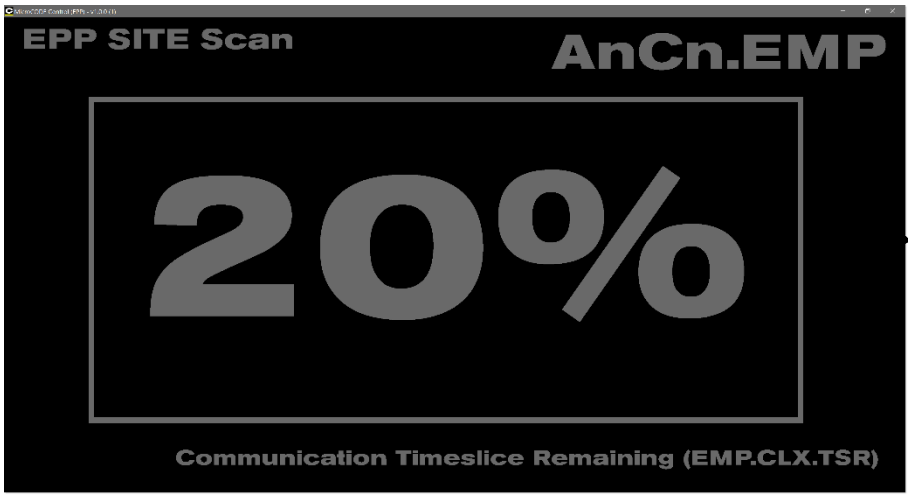
…the question / help indicator opens a Key explaining the status coloring:



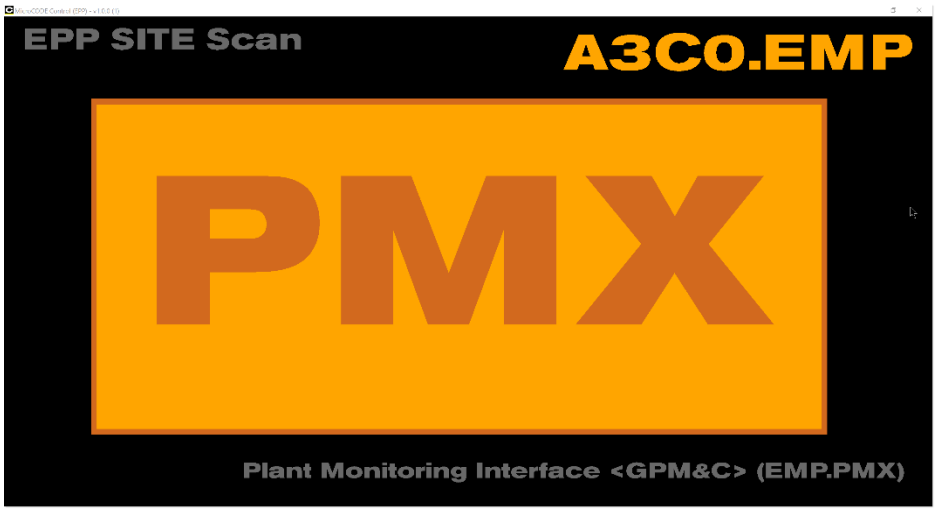
While connected to the Site, backing up from the 'Site' screen reveals a rotating monitor of all the Subsystems, in all the Cell Controllers.



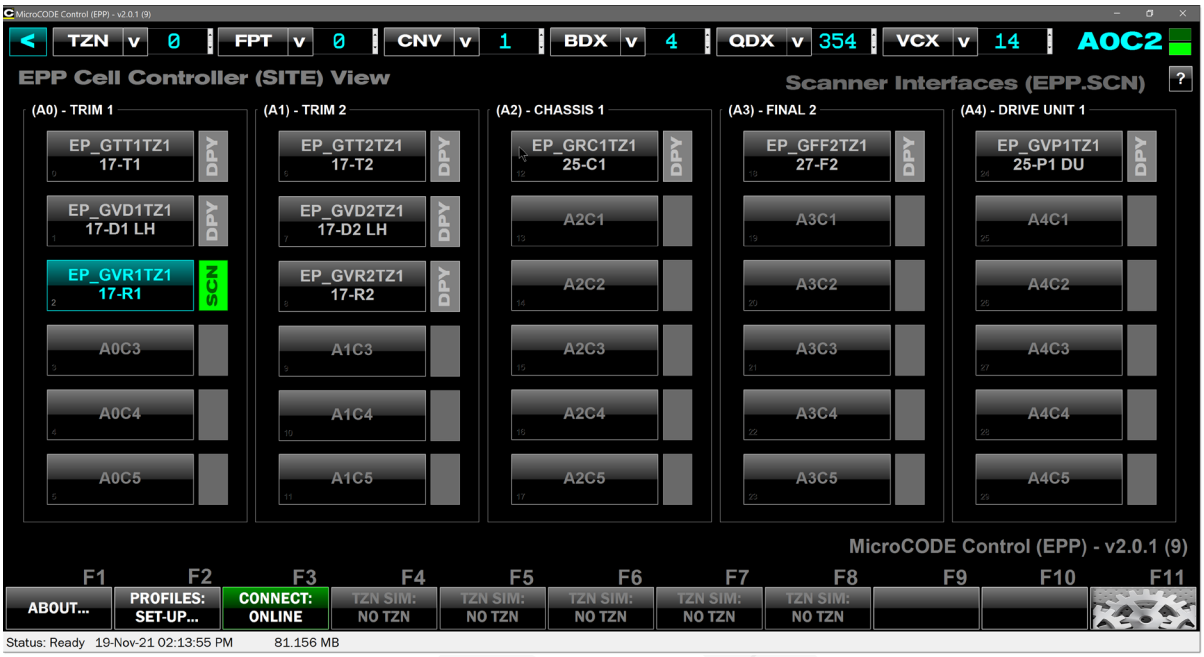
If all the EPP Subsystems in all Site Cell Controllers are fine—all Running with no Warnings, Errors, or Faults—the display rotates through them one at a time with a 'dim gray display', nice and boring.



If an abnormal condition is found the display shows the Cell Controller with the worst Subsystem state, shows the Cell Controller ID (**PnCn.PLC**) and shows the abnormal condition colorized by severity to draw attention to the issue.

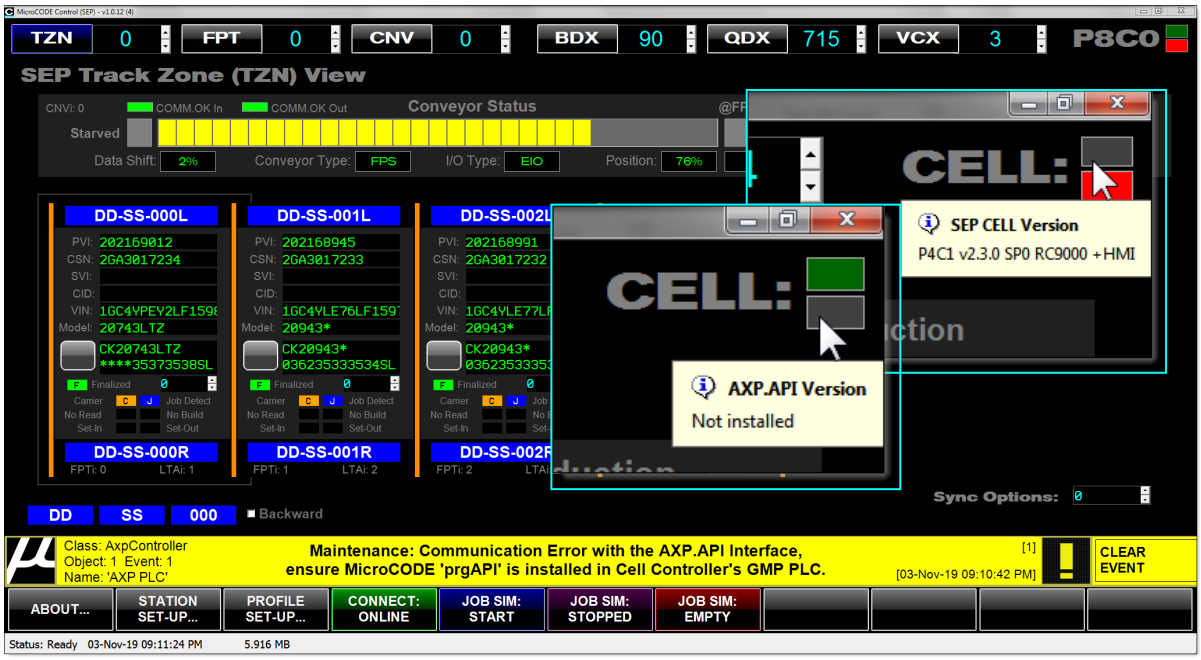


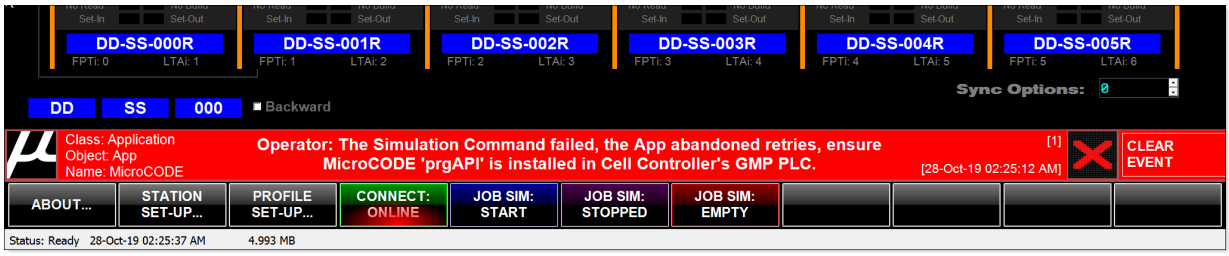
Clicking anywhere on the SITE Scan screen returns you to SITE View screen…



The App establishes two (2) distinct connections to the 'Active' EPP Cell Controller PLCs…

- The first is a connection to the 'EPP Cell Controller' – as a READ ONLY connection.
- The second is a connection to the 'MicroCODE Application Programming Interface (API)' which can be added to any EPP Cell Controller – this is a READ/WRITE connection for giving the Cell Controller simulation commands.

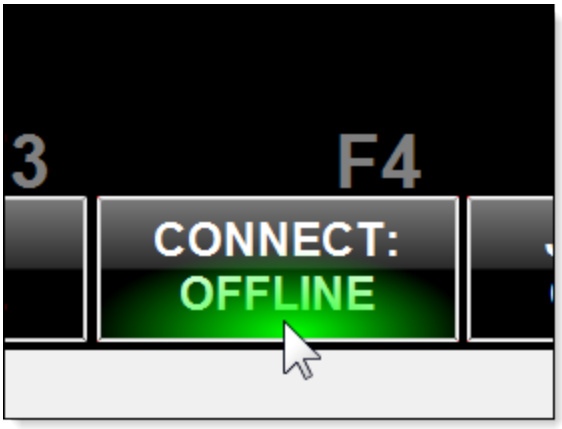




If the MicroCODE API program is not installed this App cannot write anything to the Controller, i.e.: it cannot start/stop/run a simulation; all it can do is act as a 'Viewer'.

So, it is normal in this case to get the warning and errors shown above, these can be ignored if you only want 'Viewer Mode' and closed by clicking CLEAR EVENT (or F12).

To use the App as a 'Viewer', simply click F4 **CONNECT: OFFLINE**, this button glows green to show it will start the connection if clicked.



Once ONLINE the display shows the live data from the Cell Controller…

TRACK ZONE View – FPS Conveyor

The main App Screen is used to both configure, monitor, and control all the GM EPP functions.

Track Zone Selection & Viewer

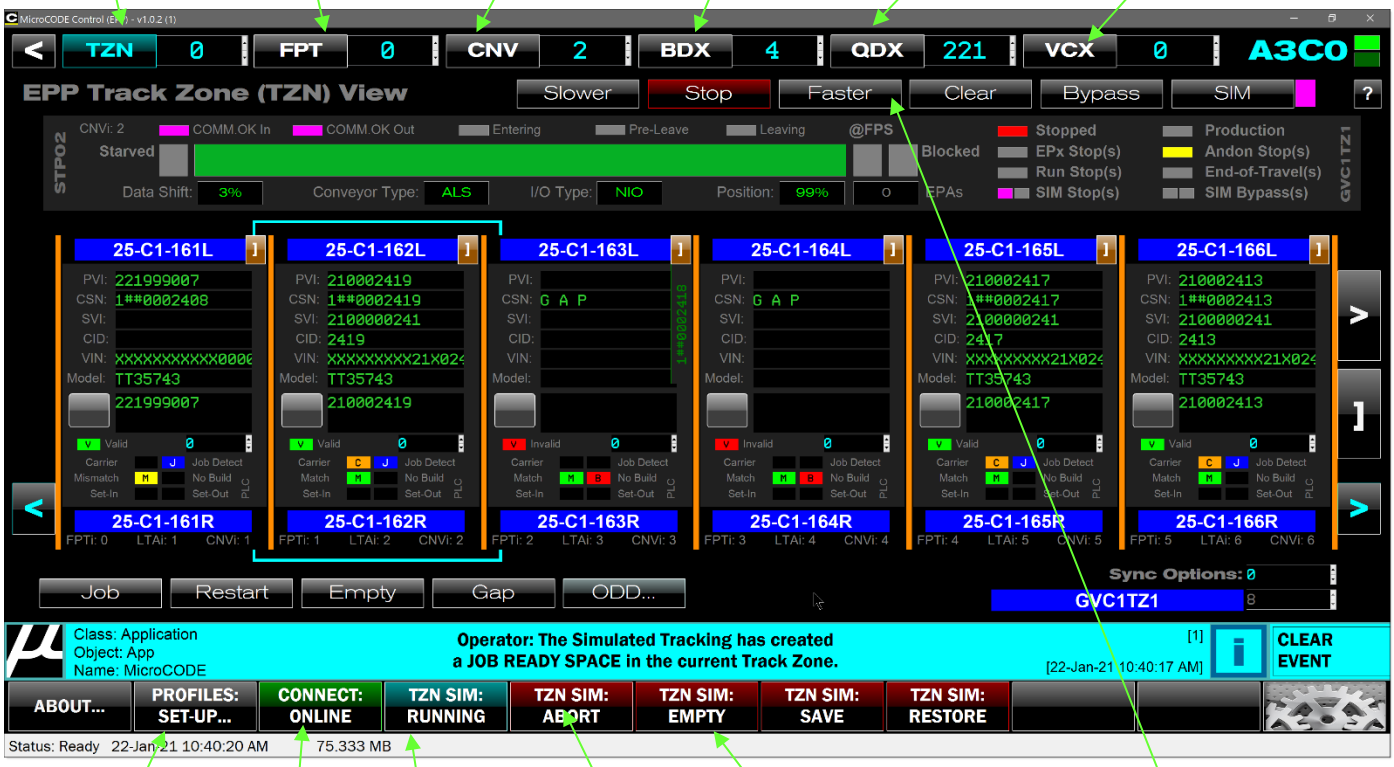
Footprint / Job Selection & Viewer

Conveyor Selection & Viewer

Build Data **'Seed'** Selection & Viewer

GSIP Queue Defect Viewer

VCVS Queue Trace Viewer



SITE Set-Up Communication Set-up, PLC connections.

Connect Connects the App to the EPP Cell Controller.

TZN SIM: Abort Aborts the simulation and restores the active Track Zone from the snap-shot.

CNV: Simulator Controls Starts or Stops simulated Conveyor motion. Clears Andon Holds, Bypasses Andon, changes Speed.

Job Control Profiles (JCP) Controls the creation of simulated Jobs.

TZN SIM: Start / Stop Toggle Starts a new stream of simulated Jobs based on the active Profile. (It starts by taking a snap-shot of the existing tracking).

TZN SIM: Empty Fill the active Track Zone with EMPTY CARRIERS.

TZN SIM: Save Takes a SNAP-SHOT of the active Track Zone only.

TZN SIM: Restore Retrieves the SNAP-SHOT of the active Track Zone only.

TRACK ZONE View – ALS / AGV / AGC / VAC Conveyors

The Track Zone screen has features to better support asynchronous conveyors.

Starting with **v1.1.1** the App supports the display of all data associated with Stop Stations, i.e.: Carrier Positions on Accumulating Lane Stop (ALS), Automated Guided Vehicles (AGVs), Vertically Adjusted Carriers (VAC), and Automated Guide Carts (AGCs).

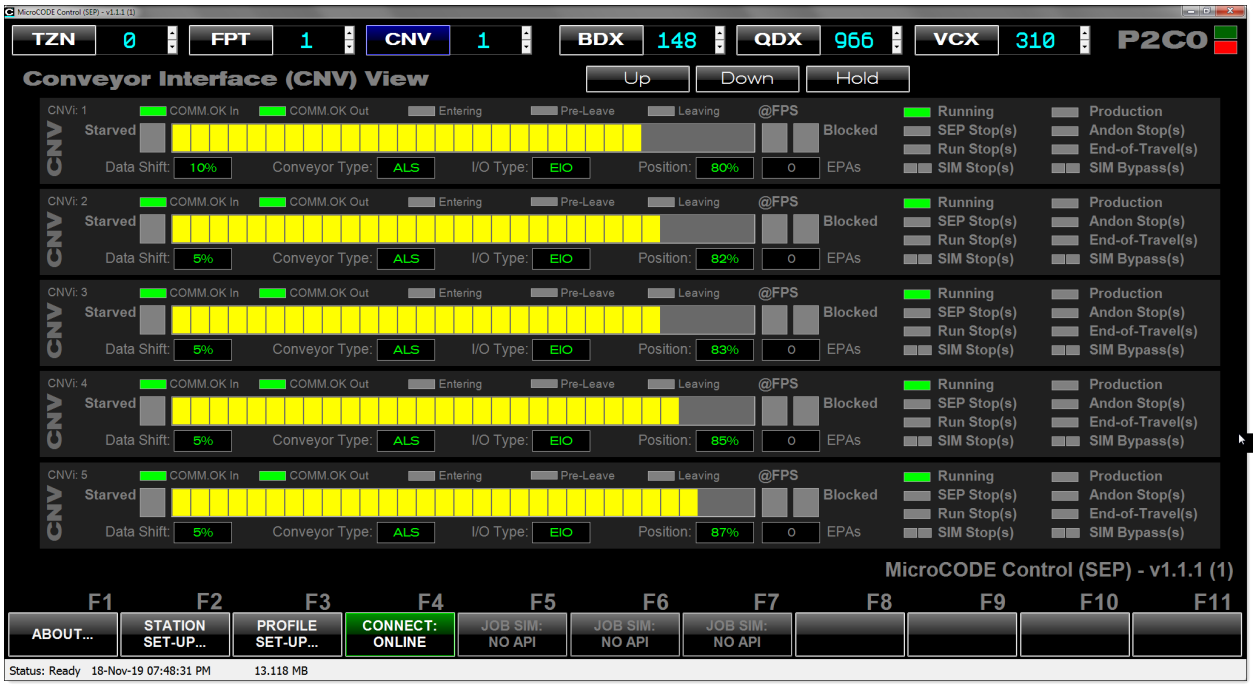
Changes for ALS Tracking Support:

Stop Station Specific Features:

Clicking on the Stop Indicator changes the Conveyor Status displayed on the top of the TZN screen to that specific Conveyor Interface, i.e.: the one for the Stop Station position.

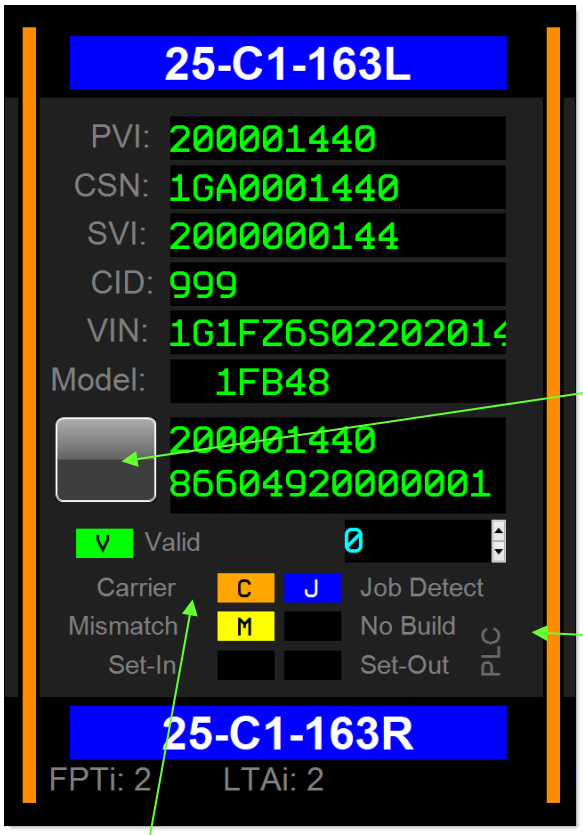
Examples of ALS Conveyor Interface displays:

Note the Entering/Pre-Leave/Leaving interlocks and asynchronous Carrier movement.



FOOTPRINT View

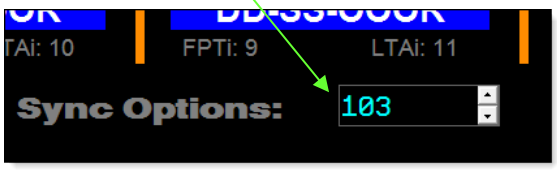
The Footprint (FPT) View is used to monitor all the Actions / Tasks in a Footprint.



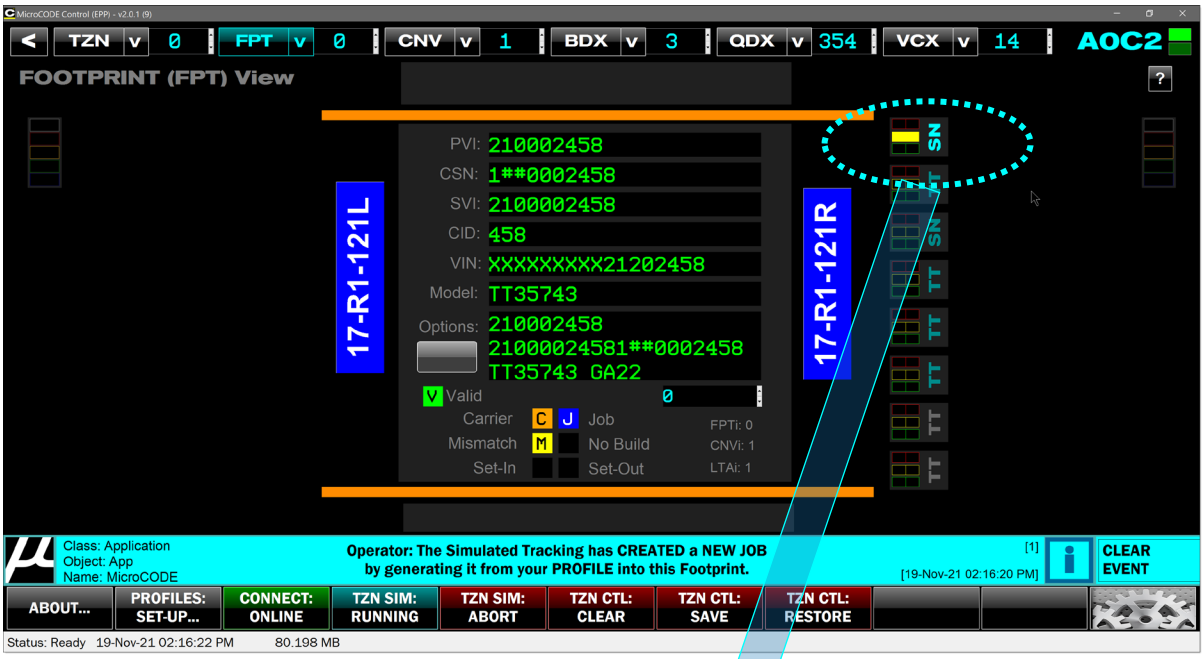
GEPICS Build Data Viewer
Instant access to the GEPICS view of data in any Footprint.
See next page.

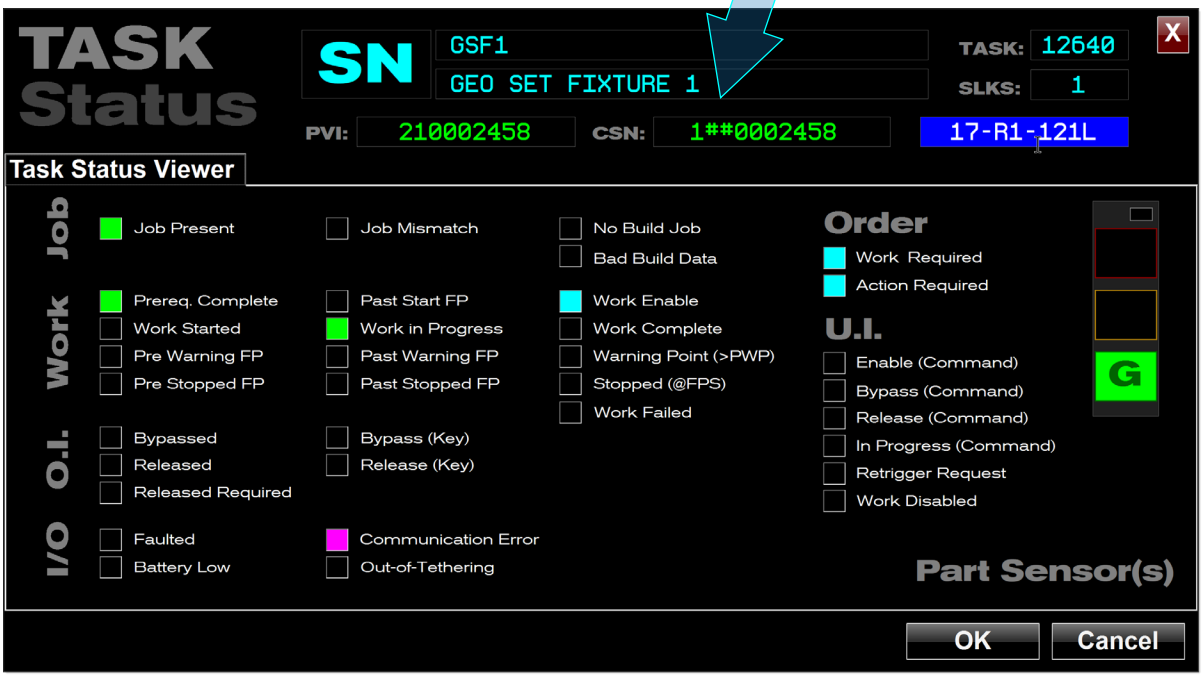
Build Data Index
By Footprint, or Sync'ed across all Footprints on screen. Controls the quick view of 32 bytes of the GEPICS Build Data Packet.

Detailed Job Status
A clear view of all the important tracking information.



Use the Footprint View to monitor the state of your Tasks as they are executed.
Clicking on a Task opens the detailed TASK Status dialog.





The Control App displays up to sixty-four (64) Tasks in the Footprint. Up to thirty-two (32) on each side. Each Task is display on the appropriate side of the Footprint.

Only the Tasks configured in the Footprint are displayed.

For each Task the App shows a representation of the LED lighted Key Switch (SLKS), along with its state, the SLKS Number (#), and the acronym representing the Task TYPE. (The TYPE and SLKS alternate in the display).

Task Types:

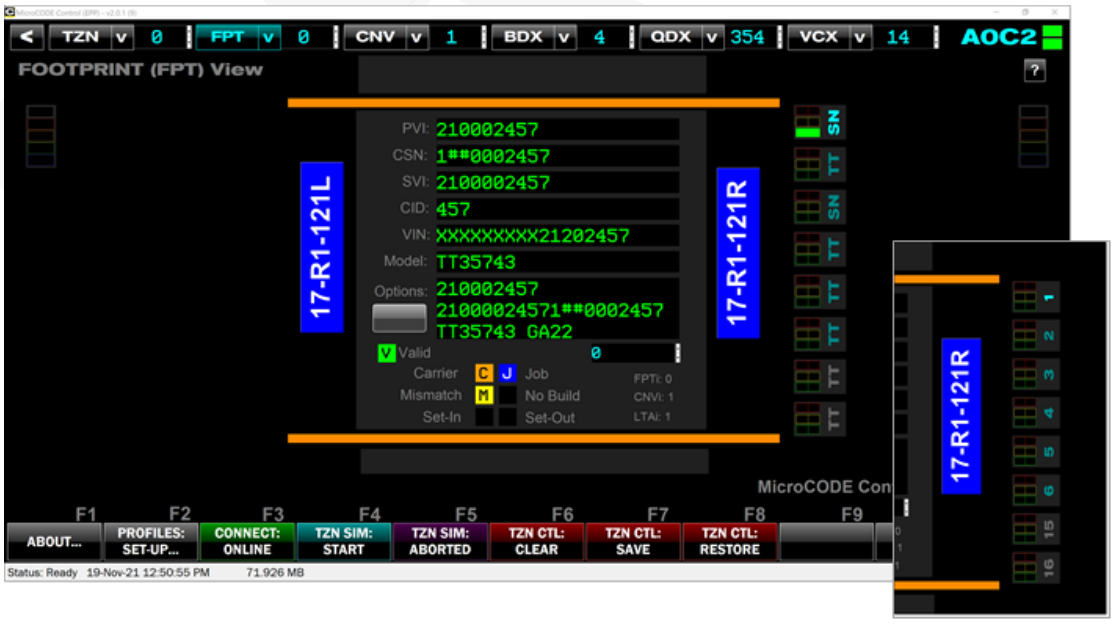
TT = Torque Tool
PP = Part Pick
BC = Part Scan (Barcode Scan)
SN = Part Sensor(s)
VC= Verify Component (Trace Scan)
PT = Process Tool
VS = Verification Station
CC = Custom Code
VV = Vision Verification

Task State at-a-glance:

Action / Task that is executing… 

Action / Task that is waiting… 

Action / Task is the not required… 



CONVEYOR View

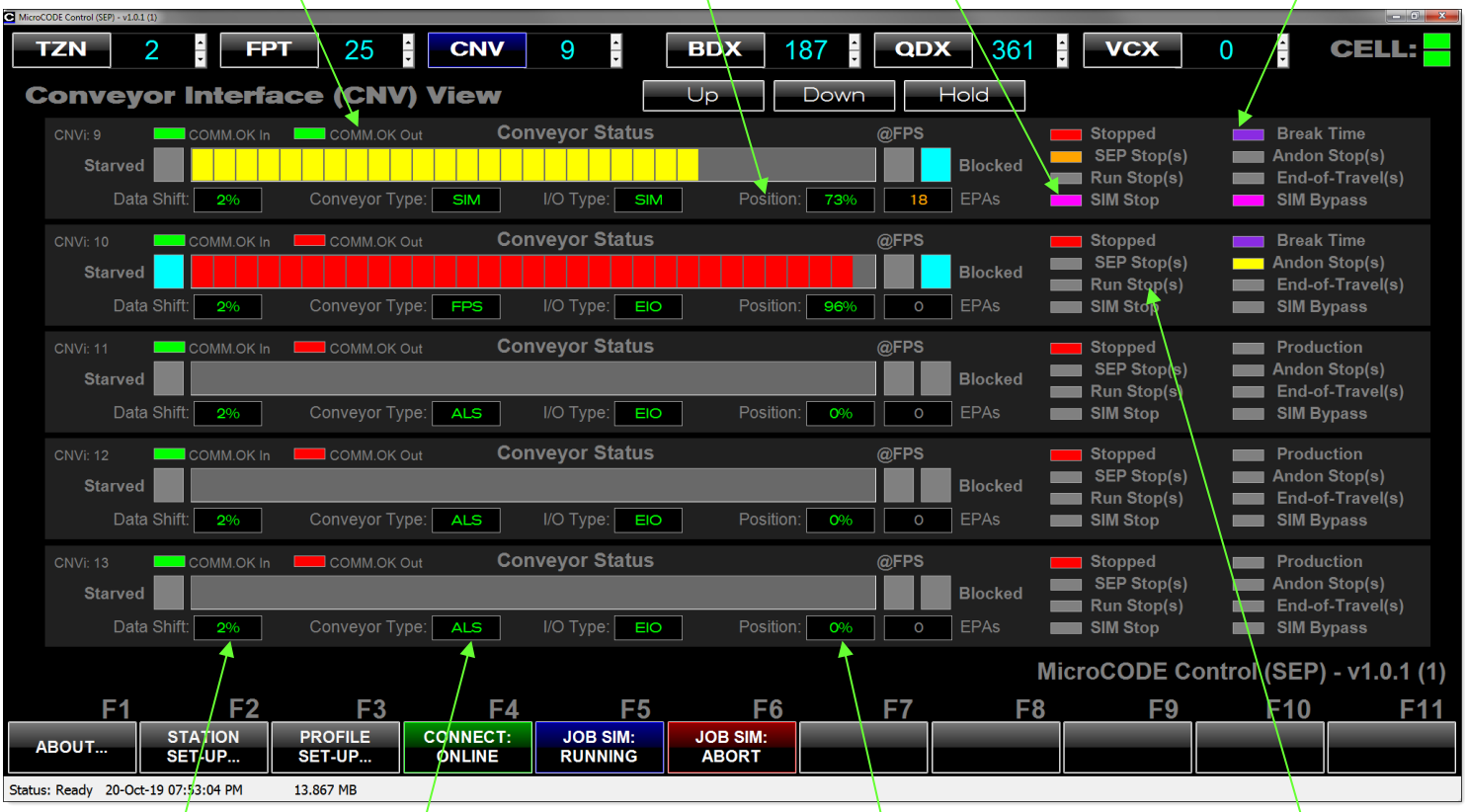
A screen to monitor multiple Conveyors in an Area all at the same time.

Five (5) Conveyors
Live view of a Conveyor group

Interface Status
Complete interface status at-a-glance

Live Count of EPP Holds
What's holding the Line?

Break Time
Production Status



Data Shift
Shift Point displayed and colorized

Conveyor and Connection Type
Both report "**SIM**" during a simulation

% Travel
Graphically and as a direct value.

Blocked and Starved
What's holding the Line?

Scroll and Sync Controls
Common to all buffer/queue viewers, the user can scroll up/down thru the data and hold the view from synchronizing to the live PLC.

BDX Buffer View

A tool to allow users to examine the Build Data Buffer within the EPP PLC, with the goal of finding 'seed jobs' for running SAT simulations.

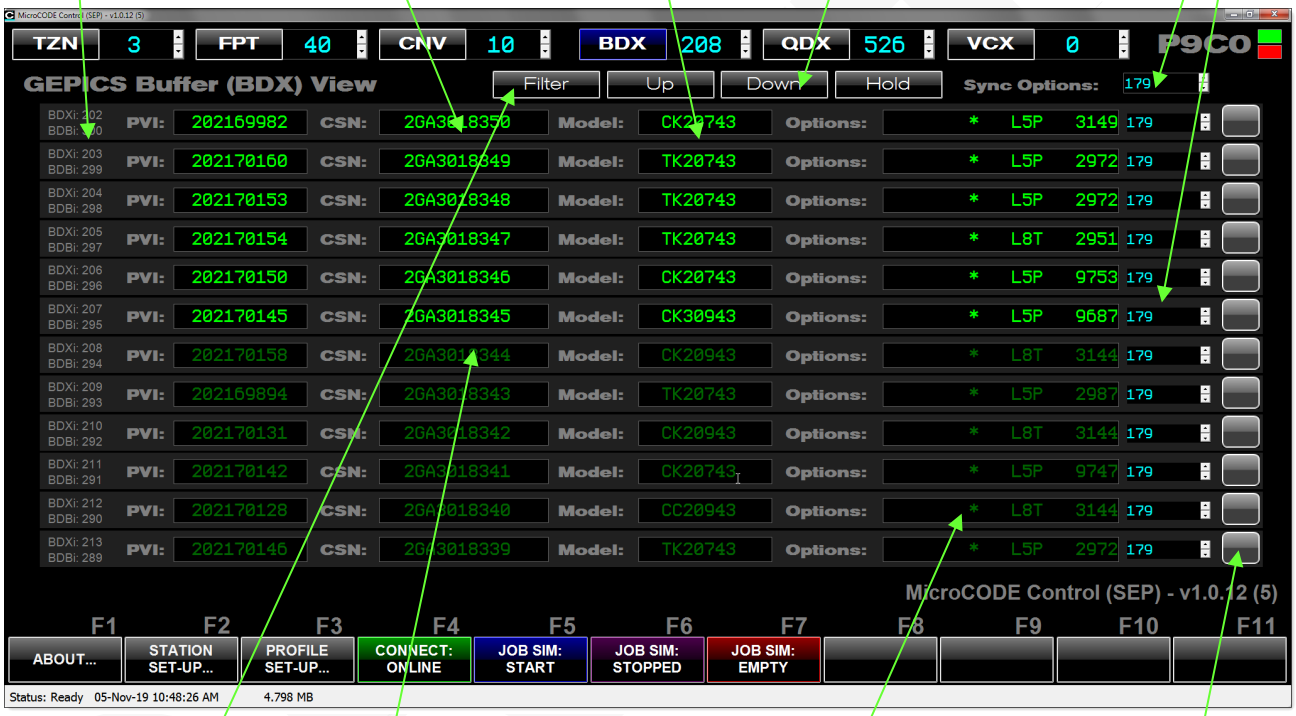
Buffer Position
Changed on-the-fly

Build Data Index
By Footprint, or Sync'ed across all Footprints on screen. Controls the quick view of 32 bytes of the GEPICS Build Data Packet.

EPP Index
PLC Location in **EPP PLC**

JOB VIDs
Vehicle IDs

JOB Model
To help locate the 'seed' Job you need.



Filtering
This allows the user to filter by PVI, CSN, or MODEL.

End of Sequence
The Track Zone's current position is clearly visible.

Option Content
RPOs, Part Numbers, etc.

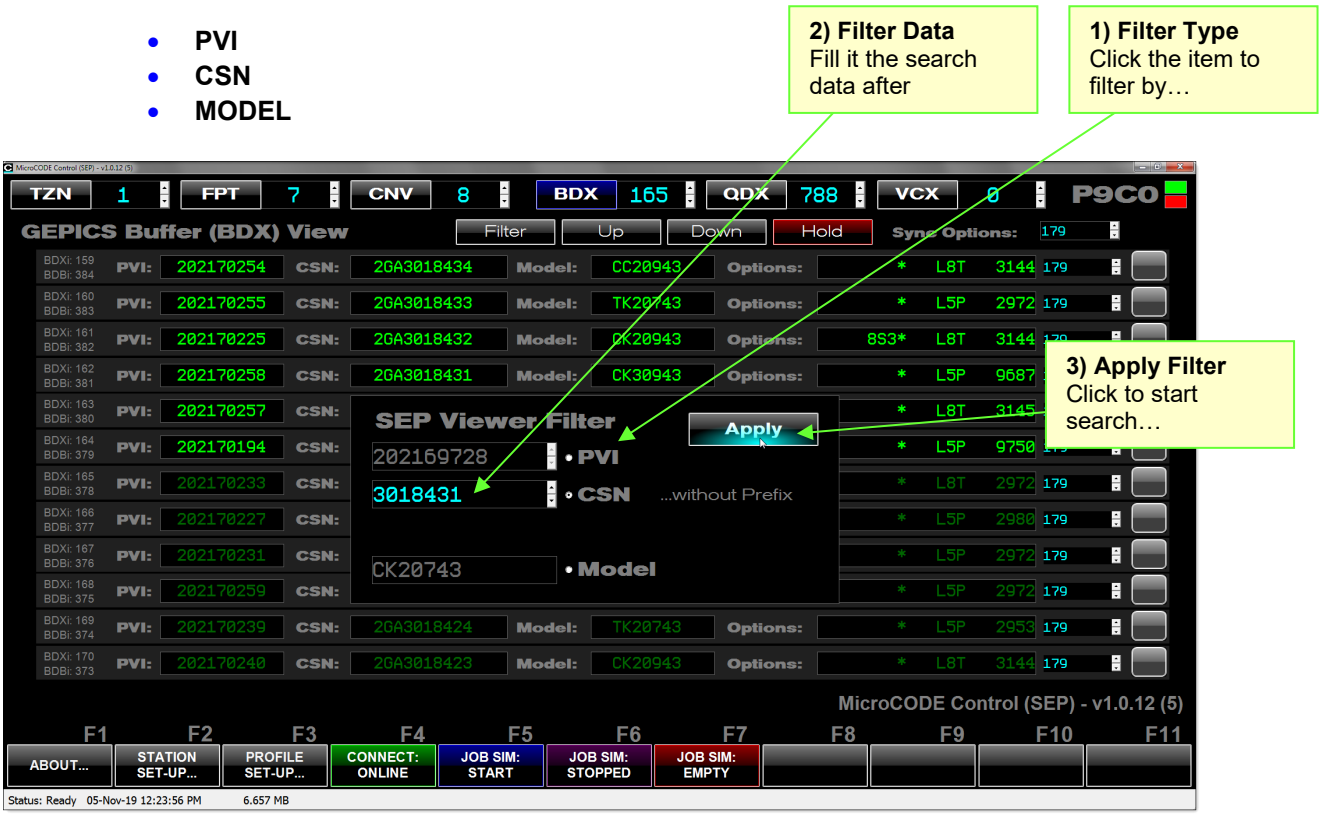
Detailed View
Opens the Vehicle Order Viewer on this Job.

Scroll and Sync Controls
Common to all buffer/queue viewers, the user can scroll up/down thru the data and hold the view from synchronizing to the live PLC.

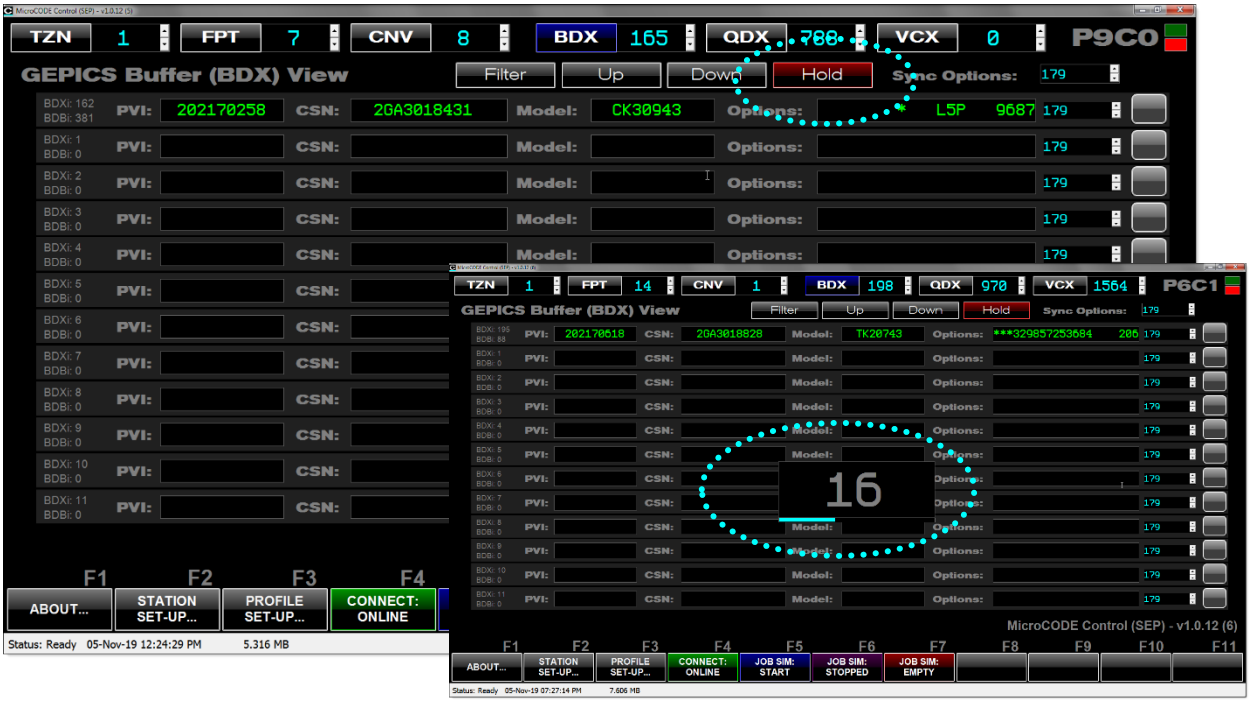
FILTERING: BDX Buffer View

The BDX Buffer View can be filtered by:

- **PVI**
- **CSN**
- **MODEL**

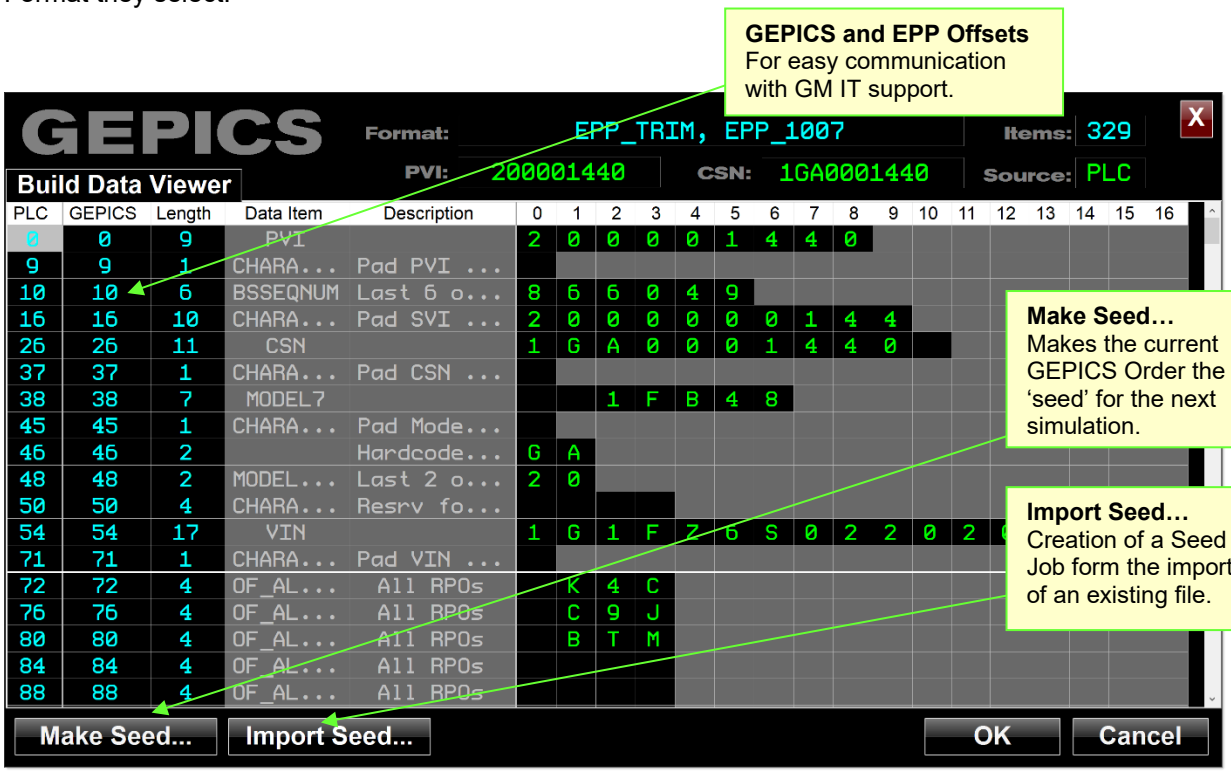


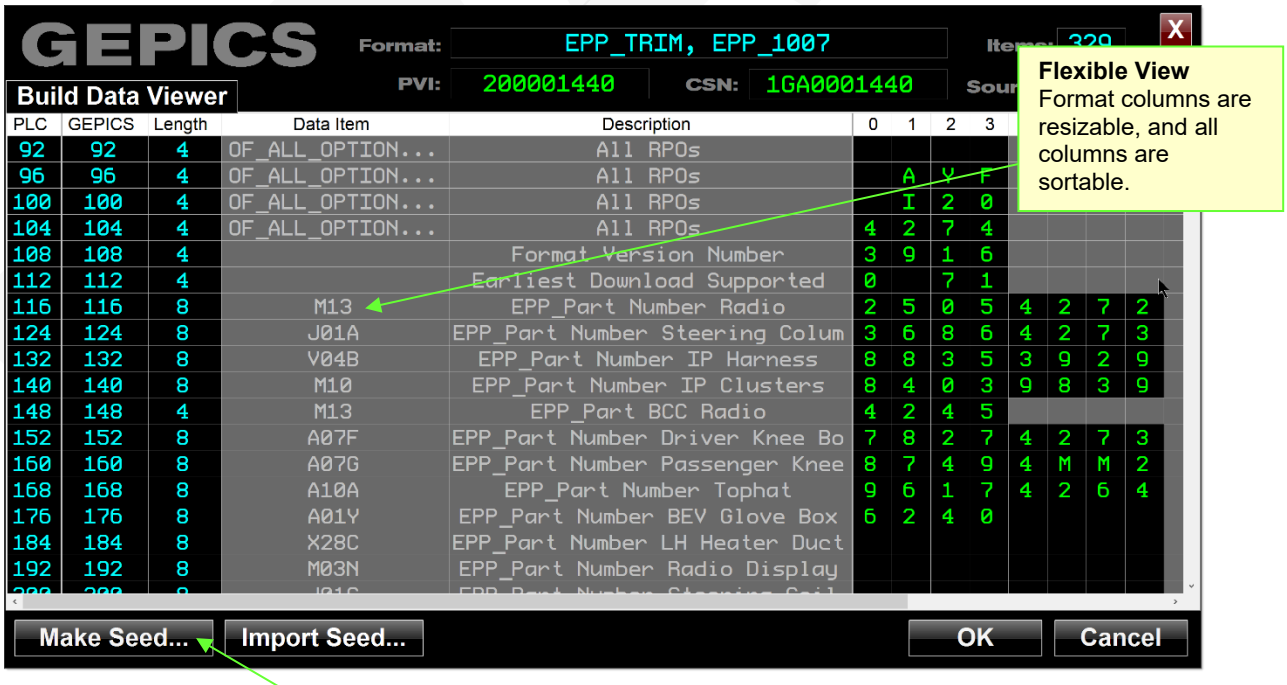
The filtered view is held until you click “Hold” to toggle it off again, and the search is visualized for the user while in progress.



GEPICS Build Data Viewer (BDV)

This Tool—available from the Track Zone (**TZN**), Footprint (**FPT**), and Build Data Buffer (**BDX**) screens—allows the User to examine the Build Data in the EPP PLCs thru the 'lens' of the GEPICS Format they select.





GEPICS Build Data Viewer (BDV) - details

This Tool—available from the Track Zone (**TZN**), Footprint (**FPT**), and Build Data Buffer (**BDX**) screens—allows the User to examine the Build Data in the EPP PLCs thru the 'lens' of the GEPICS Format they select.

GEPICS Formats
The format being uses to interpret the data (changeable on-the-fly via the **Import** button.

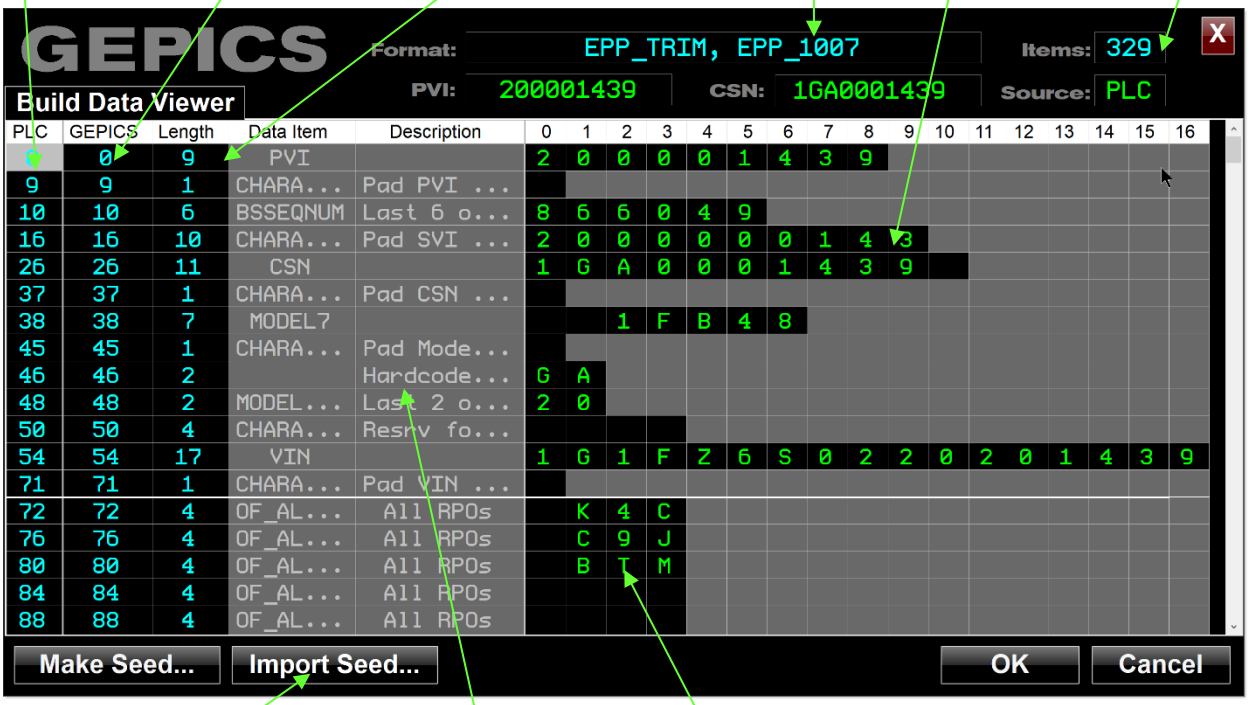
EPP Index
PLC Location in **BD [*]**

GEPICS Index
Format Location

GEPICS Length
Data Item Bytes output to EPP PLC

EPP Data
Data from PLC location

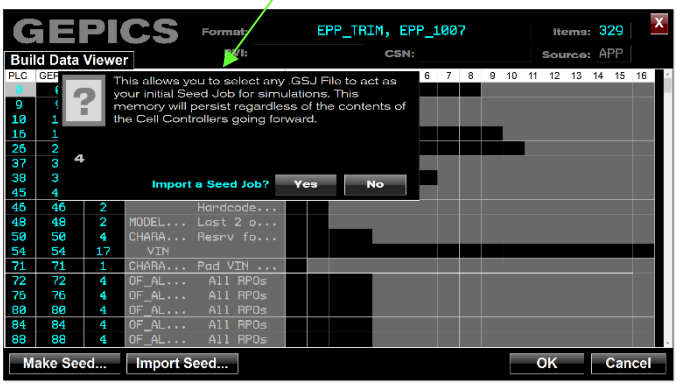
GEPICS Items
Data Items in the GEPICS Format



Import GEPICS Seed
Changes the Job being used as a Seed for simulation by importing a selected .GSJ file.

GEPICS Data Item name
Locates within GEPICS

GEPICS Data Item description
Details from GEPICS



QDX Defect Queue View

A tool to allow users to examine the Vehicle Defects Queue within the EPP PLC, with the goal of verifying Defects are generated during SAT simulations.

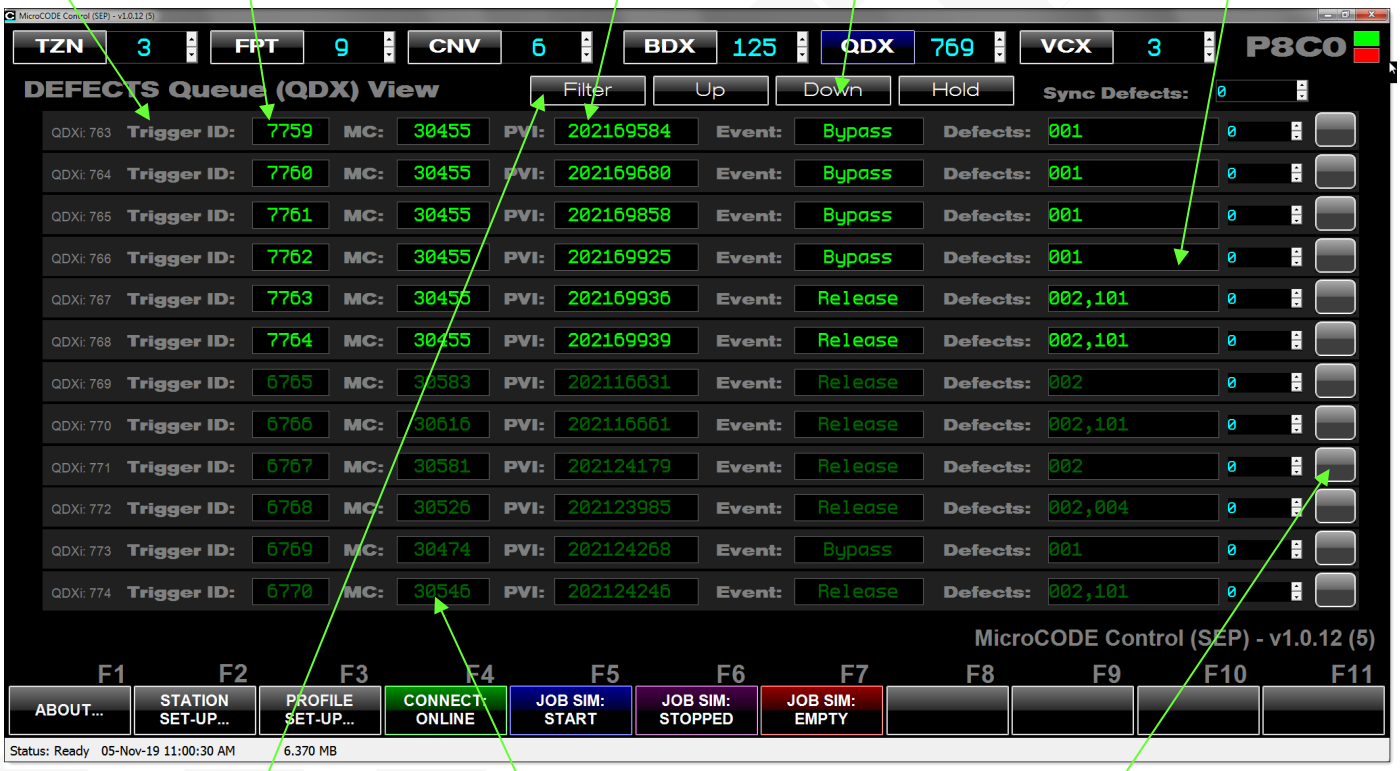
Buffer Position
Changed on-the-fly

EPP Index
PLC Location in **EPP PLC**

Trigger ID
Used to communicate with QDI

JOB PVI
The Vehicle that will hold the Defect.

Defect List (Numeric View)
The Defects that are being opened on the Vehicle.



Filtering
This allows the user to filter by PVI, or MACHINE CODE (EPA).

Machine Code
The tie to GSIP for this Process.

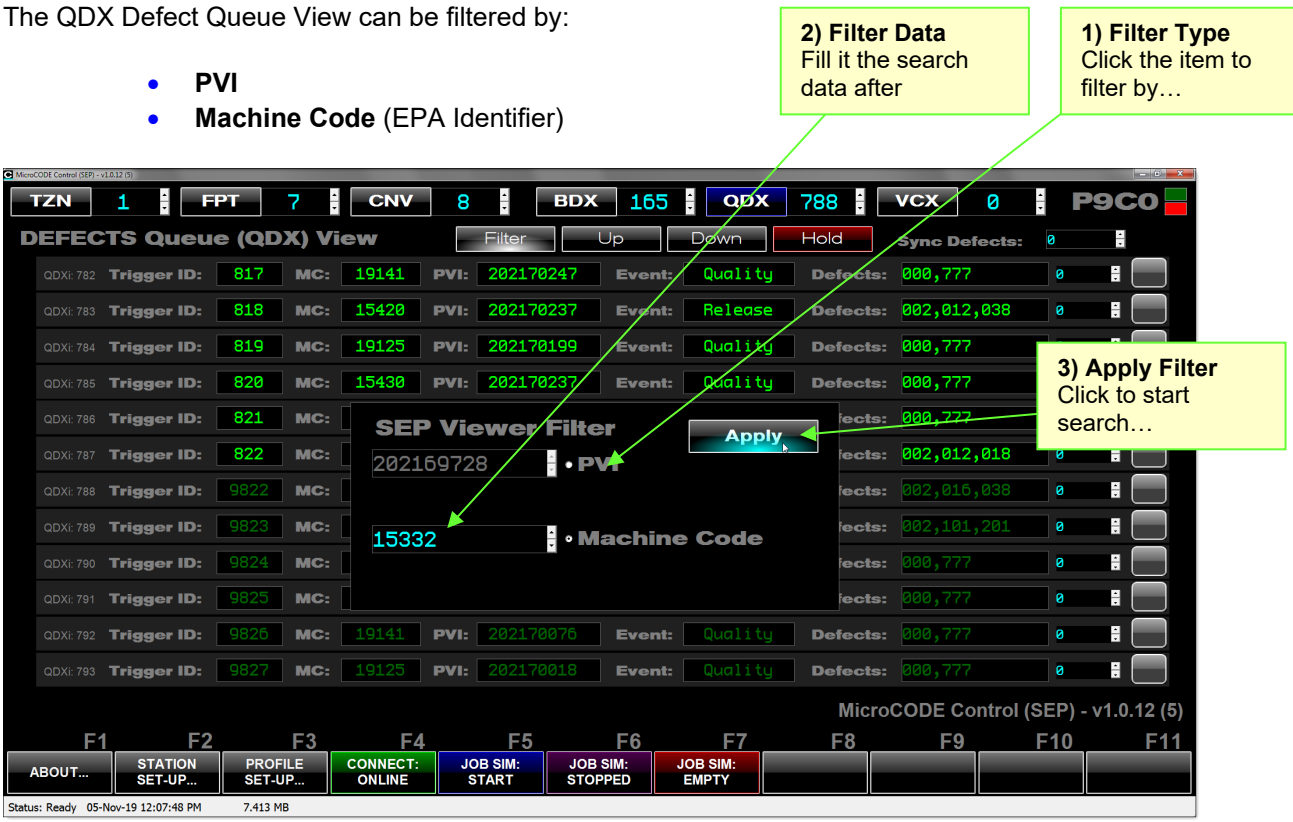
Detailed View
Opens the Vehicle Defects Viewer on this Job.

Scroll and Sync Controls
Common to all buffer/queue viewers, the user can scroll up/down thru the data and hold the view from synchronizing to the live PLC.

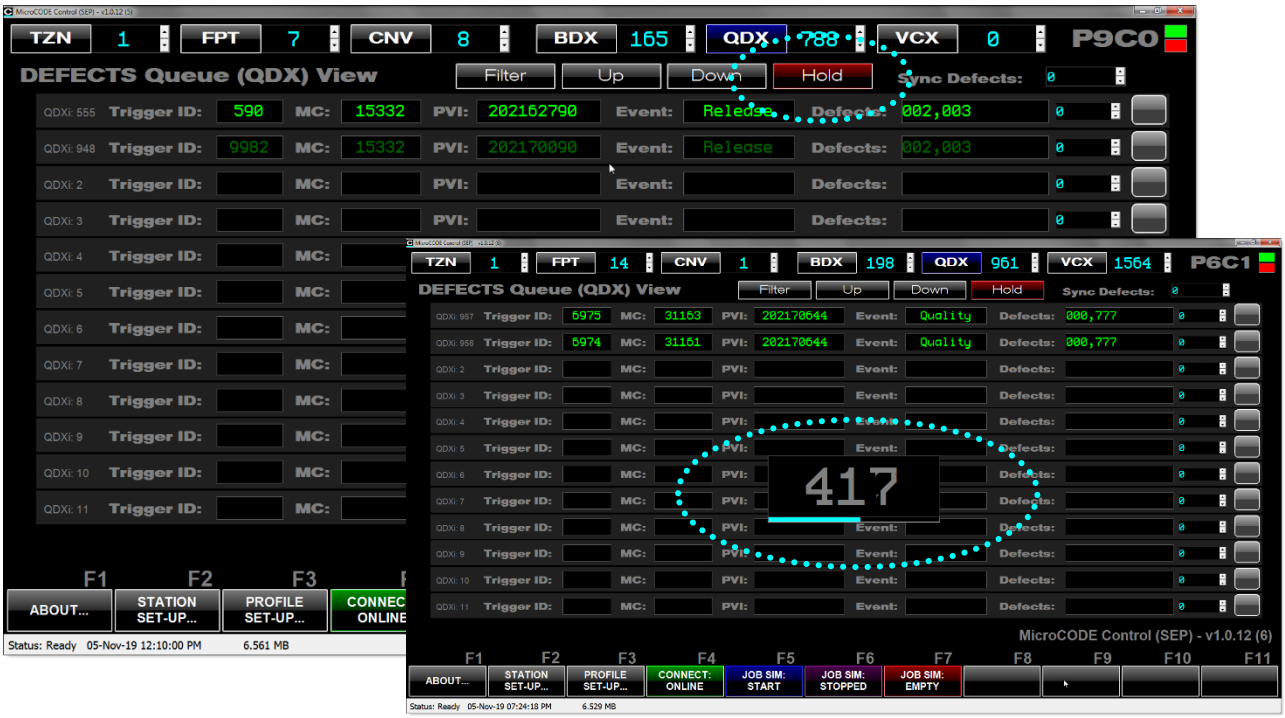
FILTERING: QDX Queue View

The QDX Defect Queue View can be filtered by:

- **PVI**
- **Machine Code** (EPA Identifier)

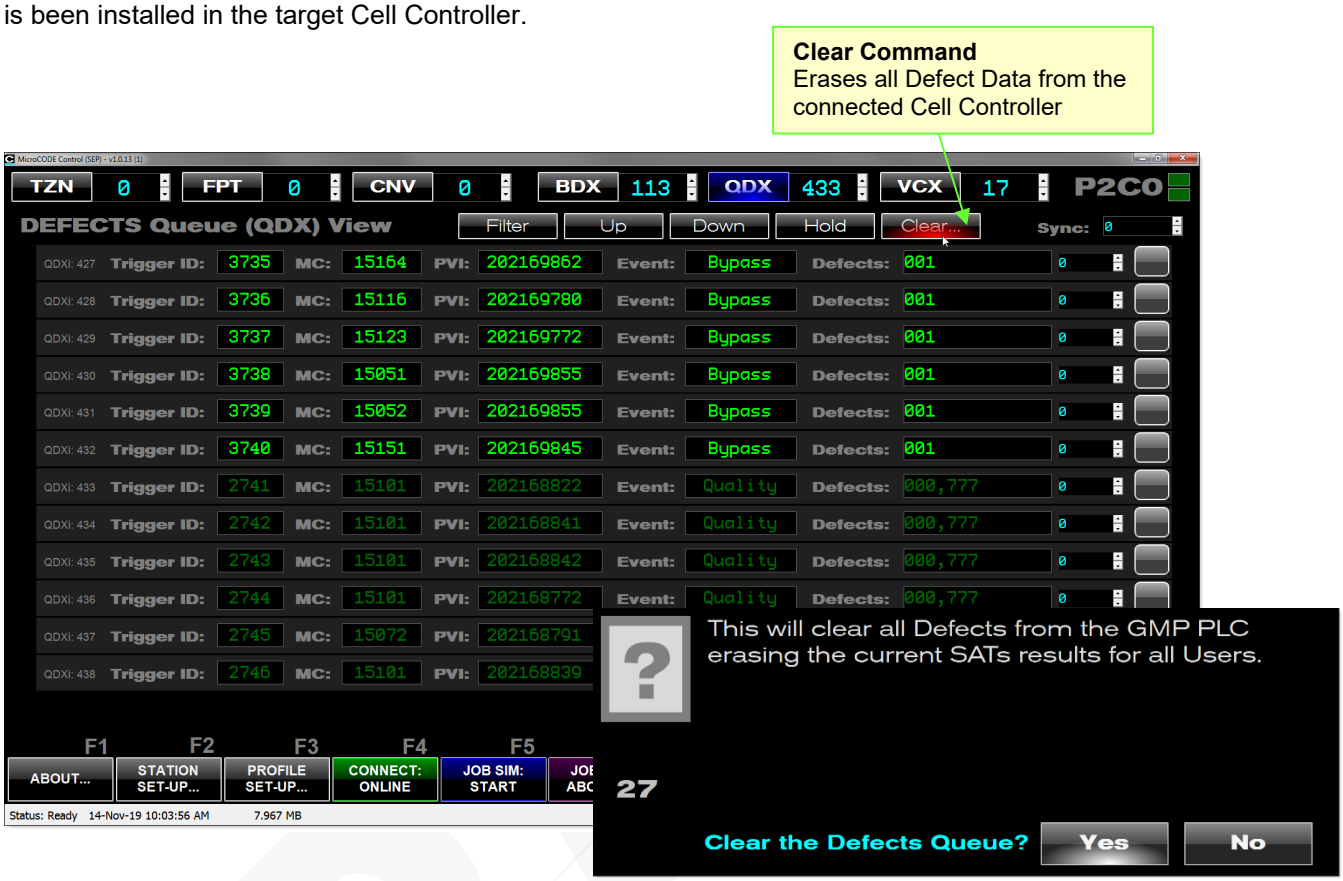


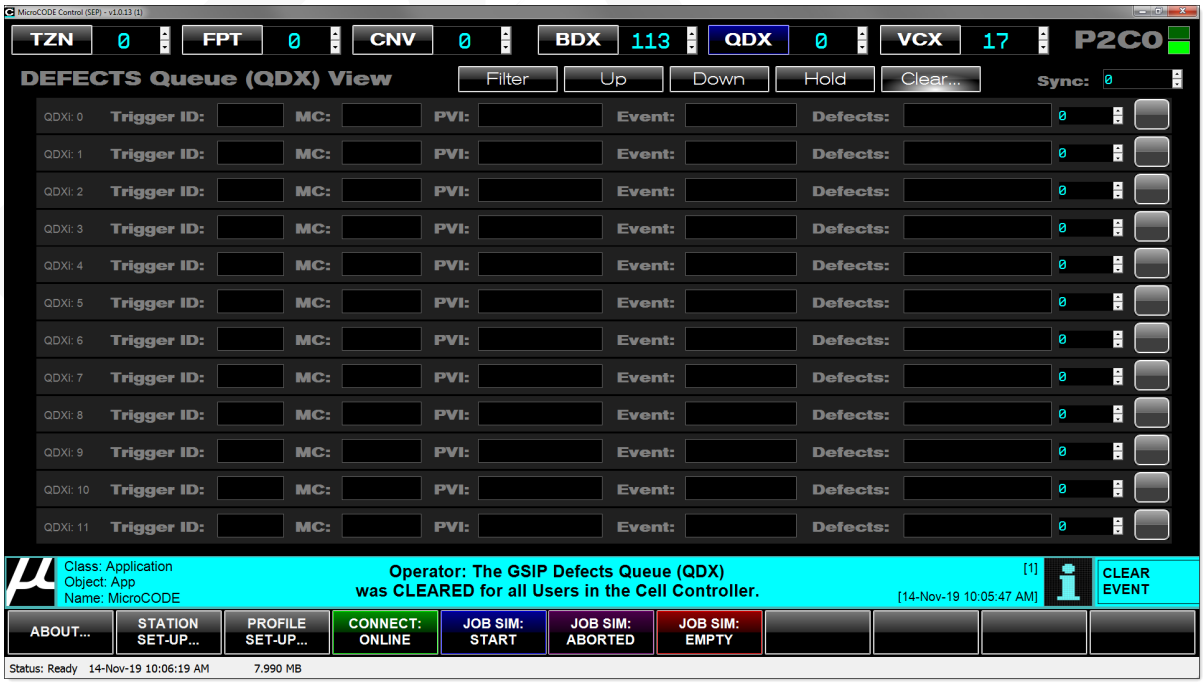
The filtered view is held until you click “Hold” to toggle it off again, and the search is visualized for the user while in progress.



CLEARING: QDX Queue

The QDX Defect Queue held within the EPP PLC can be cleared from this App as long as the **prgAPI** is been installed in the target Cell Controller.



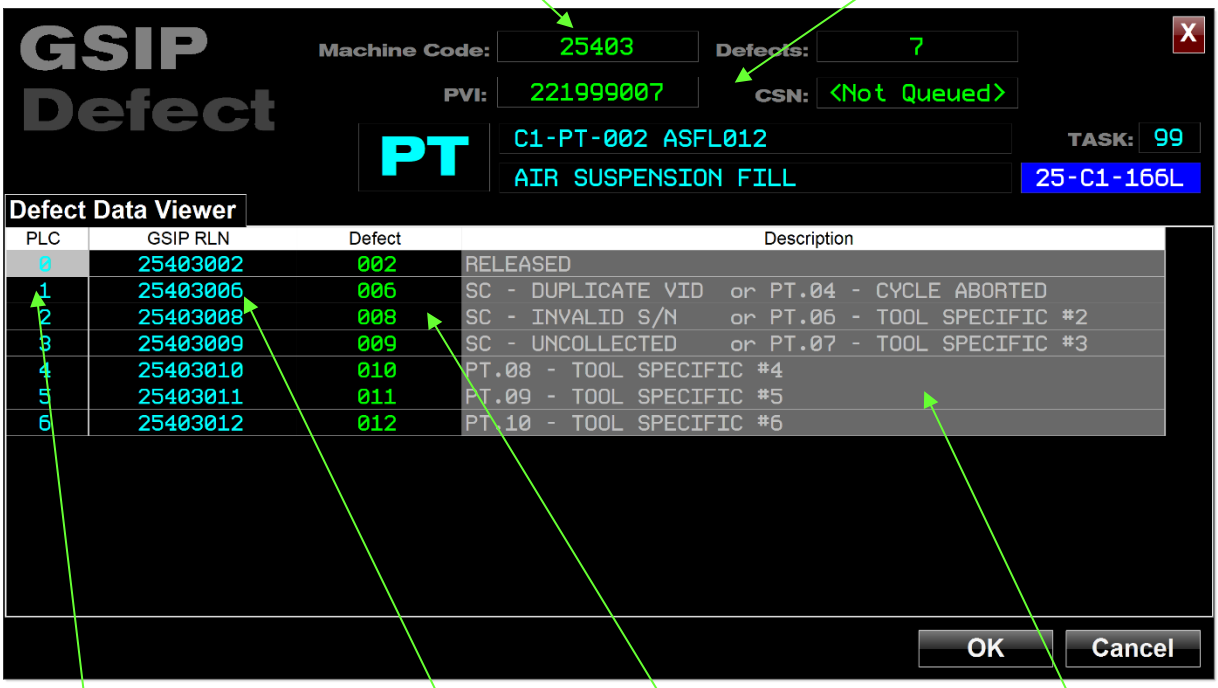


GSIP Defect Data Viewer (DDV)

This Tool—available from the Quality Defects View (**QDX**) screen—allows the User to examine the Defect Data in the EPP PLCs thru the 'lens' of the standard EPP Defect definitions.

EPA Machine Code
Unique Part/Process Identifier.

Vehicle Ids
Identification of the Job holding these Defects.



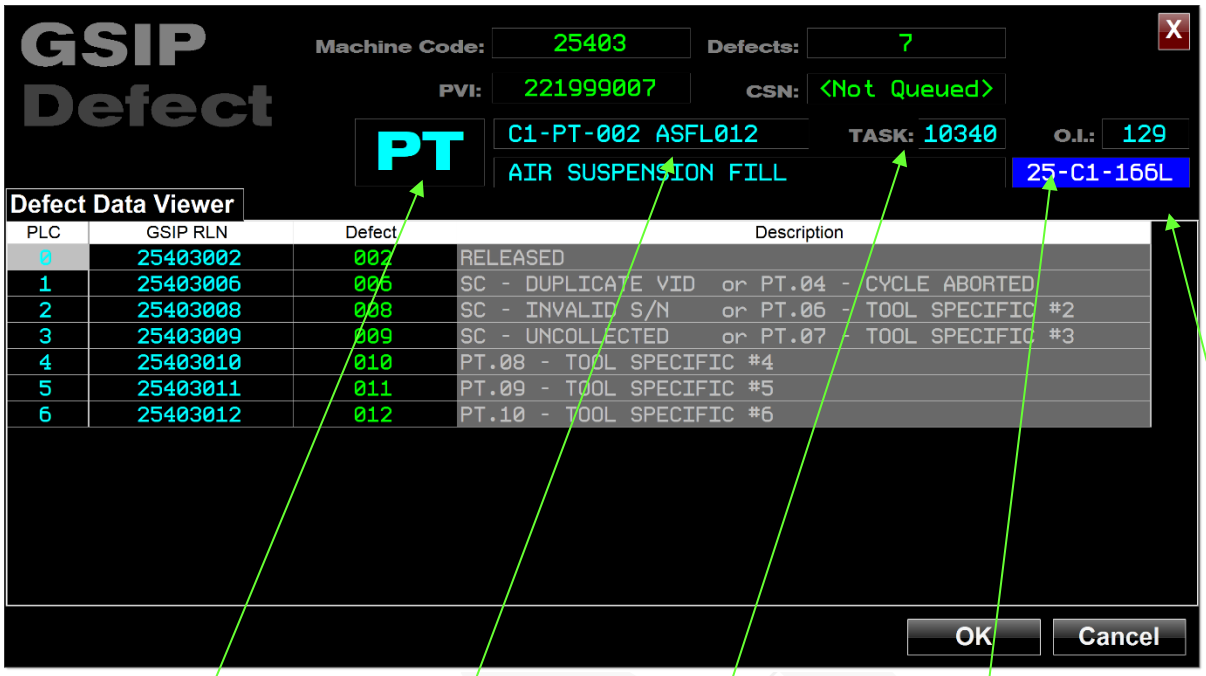
Defect Position in List
For checking against the EPP PLC.

GSIP RLNs
GSIP Defect Relationship ID for communication to GSIP Coordinator.

Defect Codes
The EPP Defect Codes generated on the Vehicle.

Defect Description
A human readable description of the Vehicle Defect.

Example 3 EPP TASK details in the App Defect Viewer



TASK Type
PP, TT, BC, PT, VC, CE, etc.

TASK Name
As entered in the error proofing system.

TASK ID
As entered in the error proofing system.

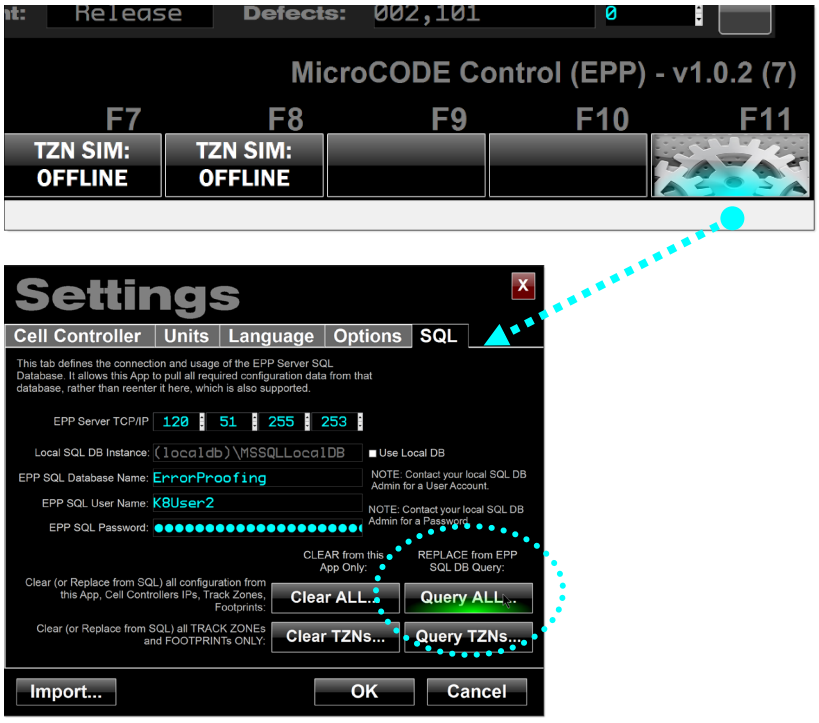
TASK O.I. (LSKS)
Unique ID within this Cell Controller for the Light Stack / Keyswitch Device.

TASK Description
As entered in the error proofing system.

TASK Location
DD-SS-OOOA
Footprint Placard.

Example 4 EPP TASK details missing in Defect Viewer

This display— “Can’t locate via Machine Code” —typically means you needs to re-query the EPP SQL Database from the SETTINGs dialog box to get the current TASK definitions. The other possibility is that no one has assigned a GSIP Machine Code to the Task.



VCX Trace Queue View

A tool to allow users to examine the Vehicle Trace Queue within the EPP PLC, with the goal of verifying Trace Data are collected during SAT simulations.

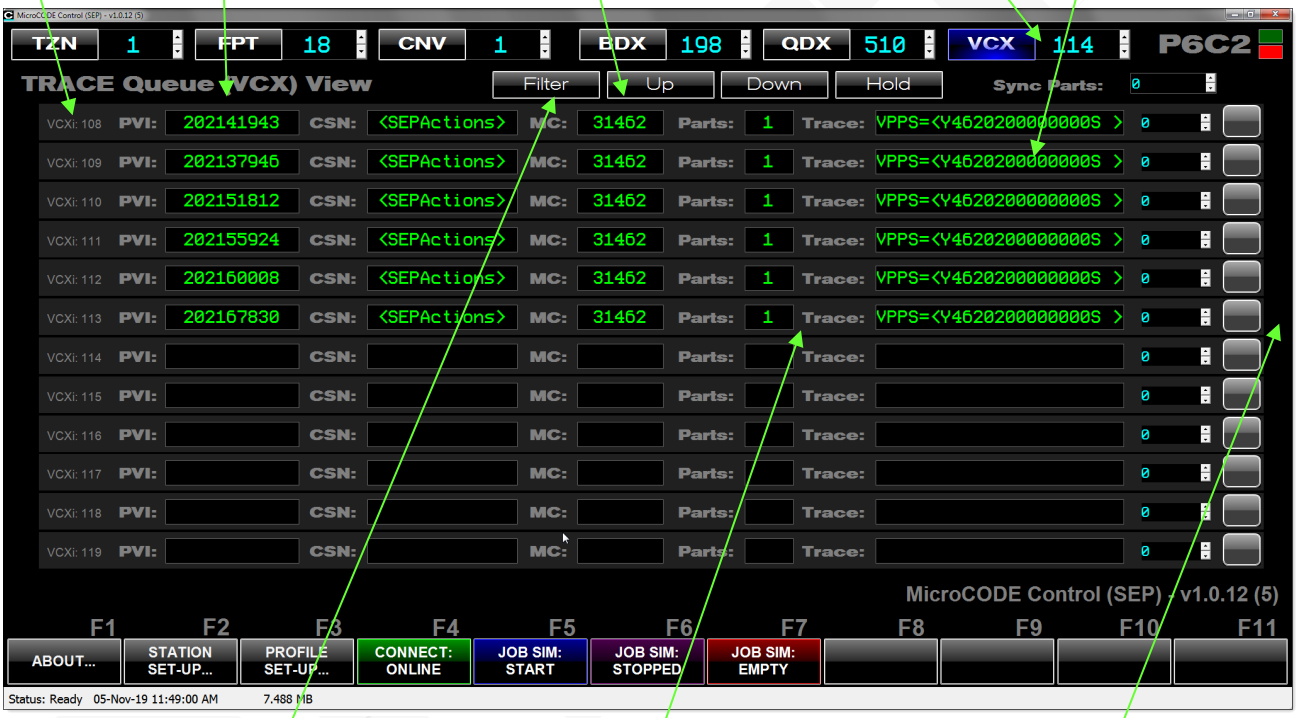
EPP Index
PLC Location in **EPP PLC**

JOB PVI
The Vehicle that will hold the Trace Data.

Machine Code
Tie to a specific process.

Buffer Position
Changed on-the-fly

Trace Data (Numeric View)
The Trace Data that is being collected on the Vehicle.



Filtering
This allows the user to filter by PVI, CSN, or MACHINE CODE (EPA).

Part Count
Number of parts collected in this transaction.

Detailed View
Opens the Vehicle Trace Viewer on this Job.

Scroll and Sync Controls
Common to all buffer/queue viewers, the user can scroll up/down thru the data and hold the view from synchronizing to the live PLC.

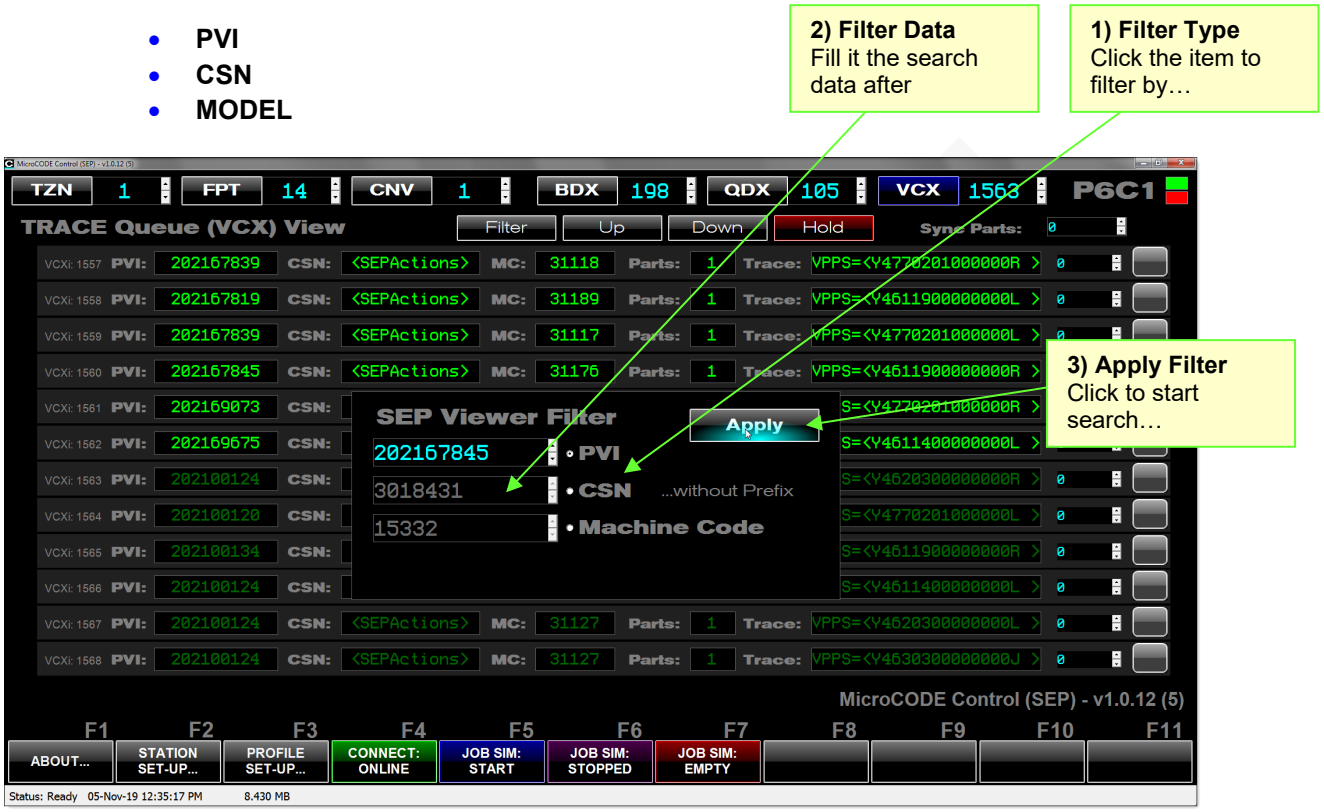
GM-1737 Support in TRACE VIEW

The App now supports detecting and displaying GM-1737 Trace Data within the EPP PLC in both the VCX Trace Queue View and Trace Data Examiner...

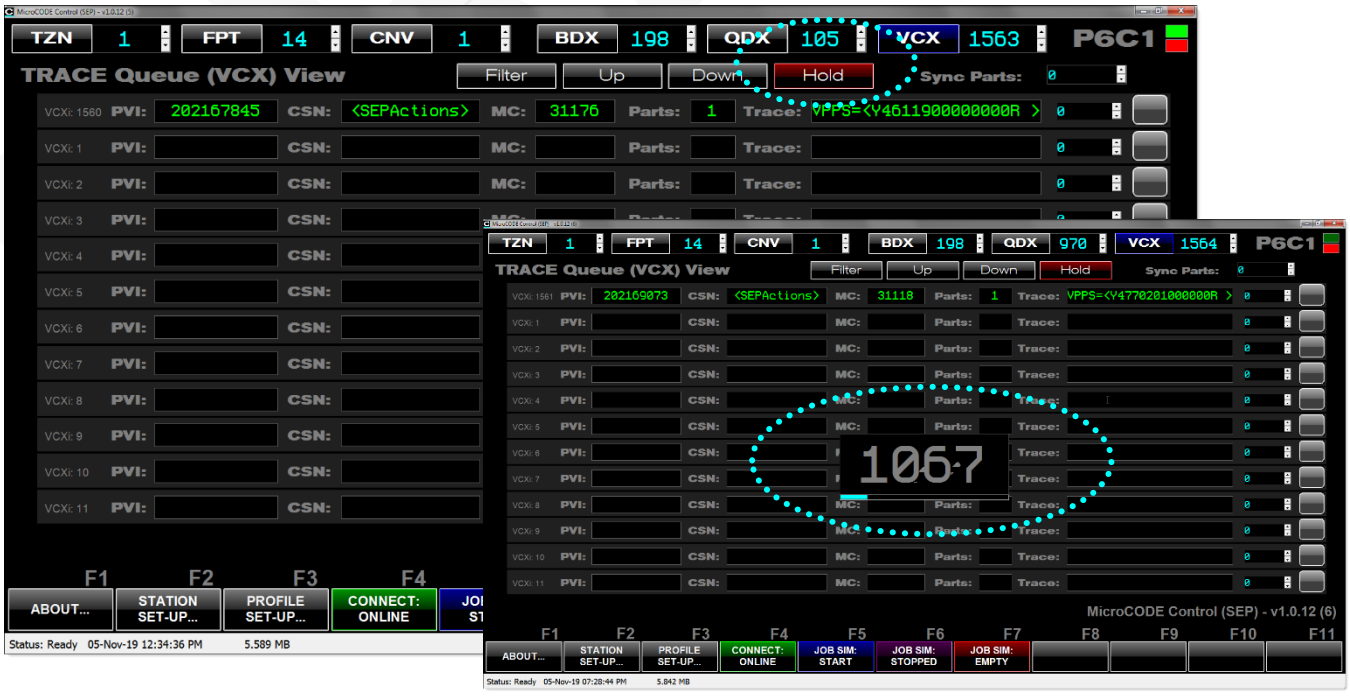
FILTERING: VCX Trace Queue View

The VCX Trace Queue View can be filtered by:

- **PVI**
- **CSN**
- **MODEL**



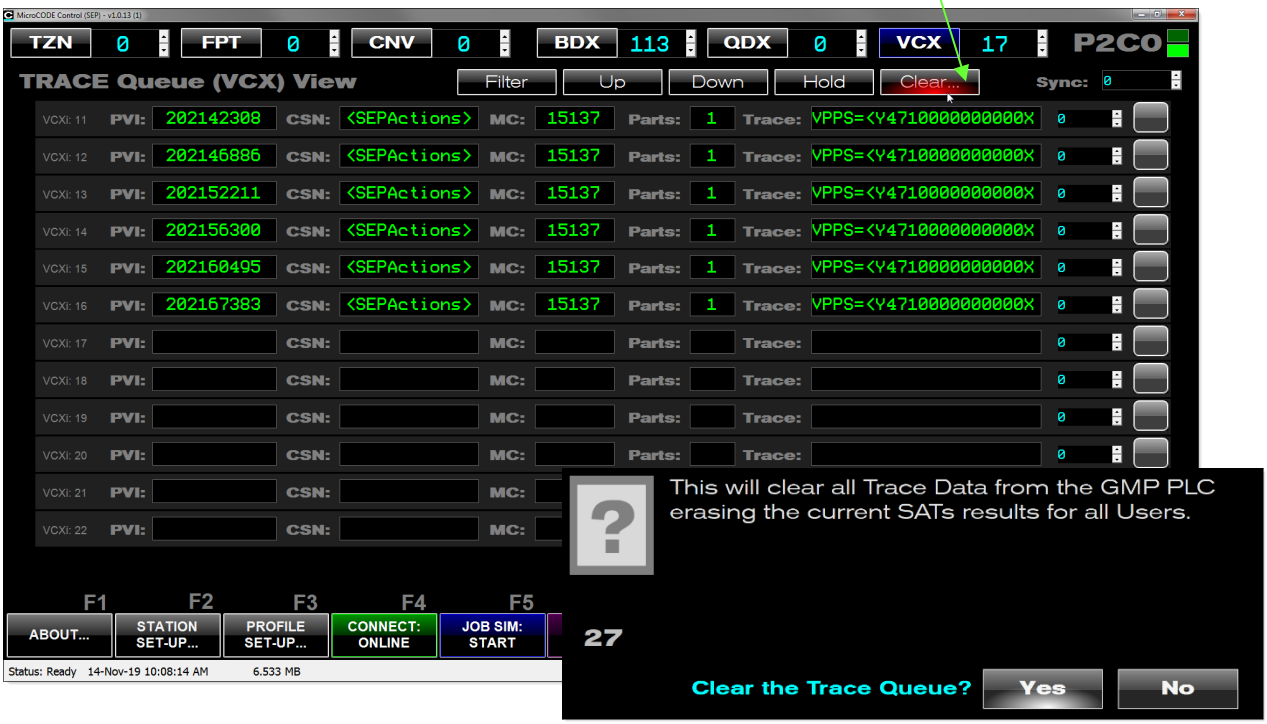
The filtered view is held until you click “Hold” to toggle it off again, and the search is visualized for the user while in progress.

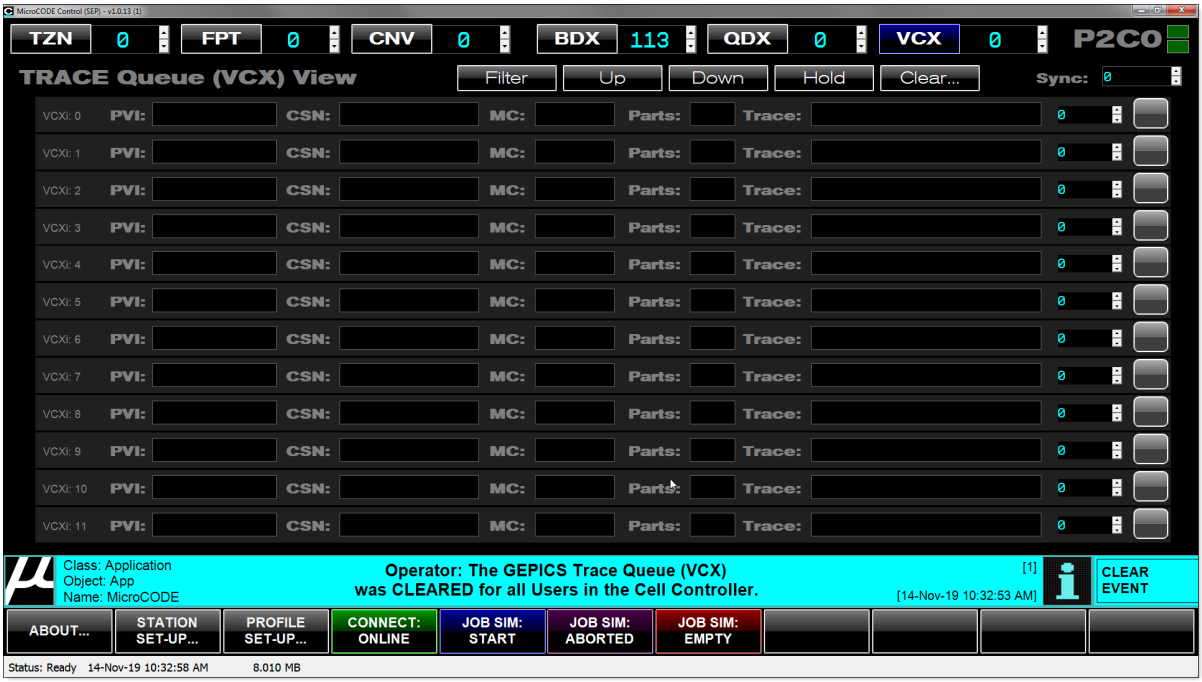


CLEARING: VCX Queue

The VCX Trace Queue held within the EPP PLC can be cleared from this App as long as the **prgAPI** is been installed in the target Cell Controller.

Clear Command
Erases all Trace Data from the connected Cell Controller



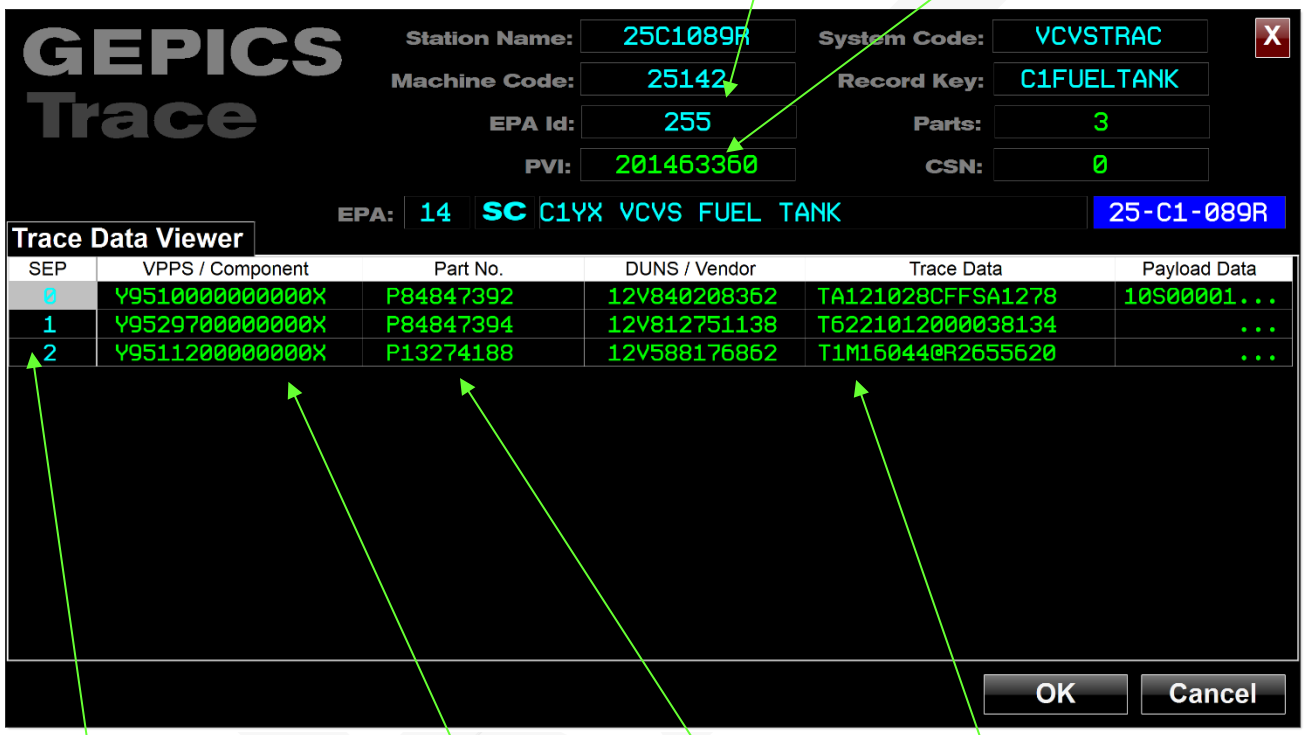


GEPICS Trace Data Viewer (TDV)

This Tool—available from the Quality Defects View (**VCX**) screen—allows the User to examine the Defect Data in the EPP PLCs thru the 'lens' of the standard EPP Defect definitions.

EPA ID + Machine Code
Unique Part/Process Identifier.

Vehicle Ids
Identification of the Job holding these Parts.



Part Position in List
For checking against the EPP PLC.

VPPS
The Component ID (Vehicle Part Positioning System).

Part Number
Standard 8 Digit GM Part Number.

Trace Data
The data, like Serial Number, that uniquely identifies a specific part in a single Vehicle.

5 Configuring the Simulated Vehicle Orders

The main purpose of this App is to be a 'Generator' of simulated GEPICS Vehicle Orders and provide a 'Viewer' to check the results of running SATs.

In order to generate Vehicle Orders the App and User needs three (3) things:

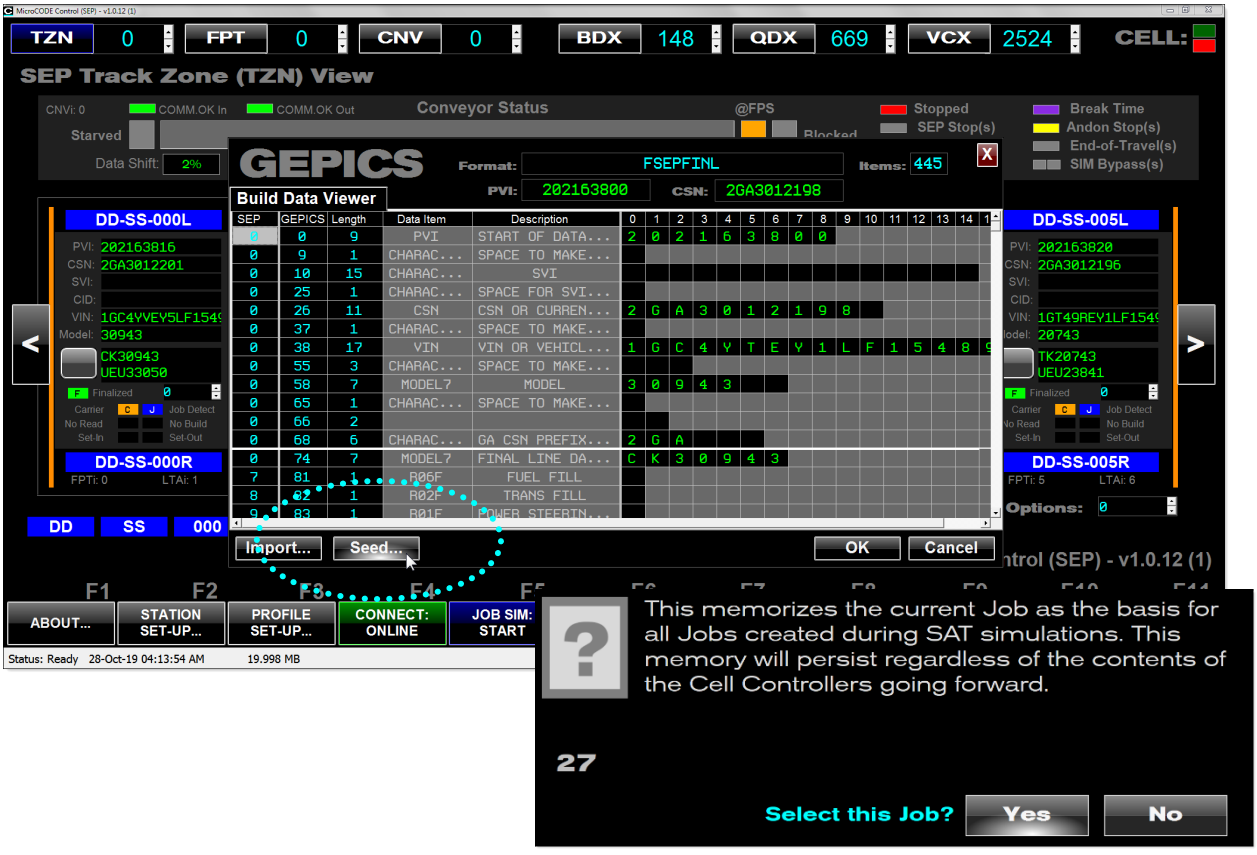
- A GEPICS Order from a EPP PLC* to act as a 'Seed Job'.
- The corresponding GEPICS 'Format' Definition File.
- A Job Control Profile (JCP) configured into this App.

Selecting a GEPICS Seed Job

Any Job Order being viewed in the App's GEPICS Viewer can be used as the new 'Seed Job' by simply clicking "**Seed…**". This can even be changed while the simulation is running.

Sources of Jobs:

- EPP – Line Tracking Array (Tracking Image Tag)
- EPP – GEPICS Build Data Buffer (GEPICS ODD Tag)

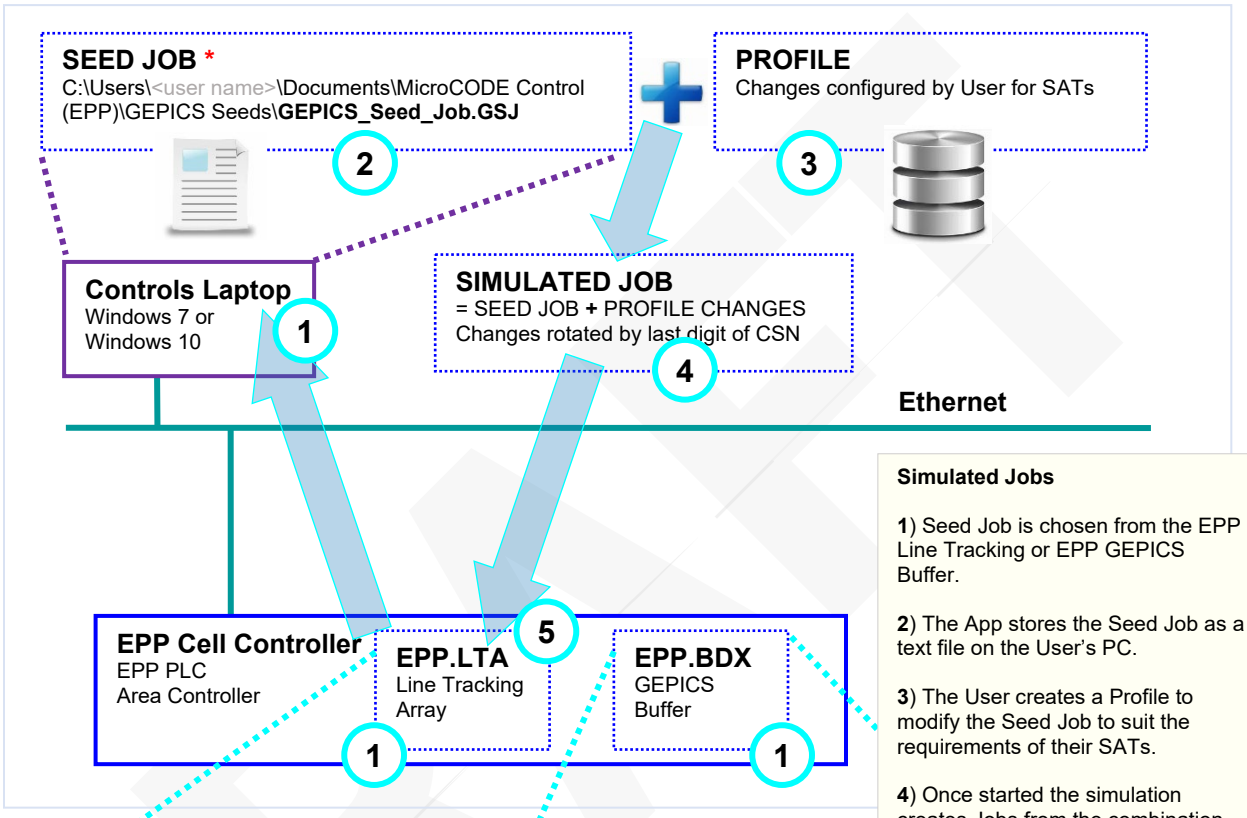


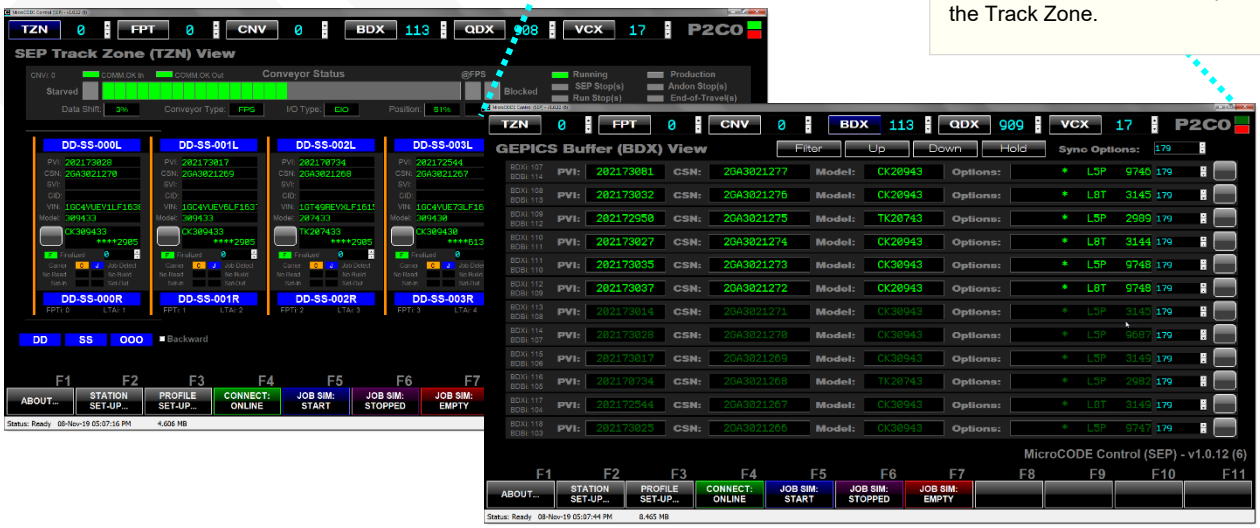
* Once a "Seed Job" has been selected it is stored as a text file, this text file can be emailed to other users who may not have access to a loaded a EPP PLC.

Figure 7 The SIMULATED JOB Process

This is an illustration of how the Seed Job Process works, showing data sources, data storage, and data flow.

* Once a "Seed Job" has been selected it is stored as a text file, this text file can be emailed to other users who may not have access to a loaded a EPP PLC.



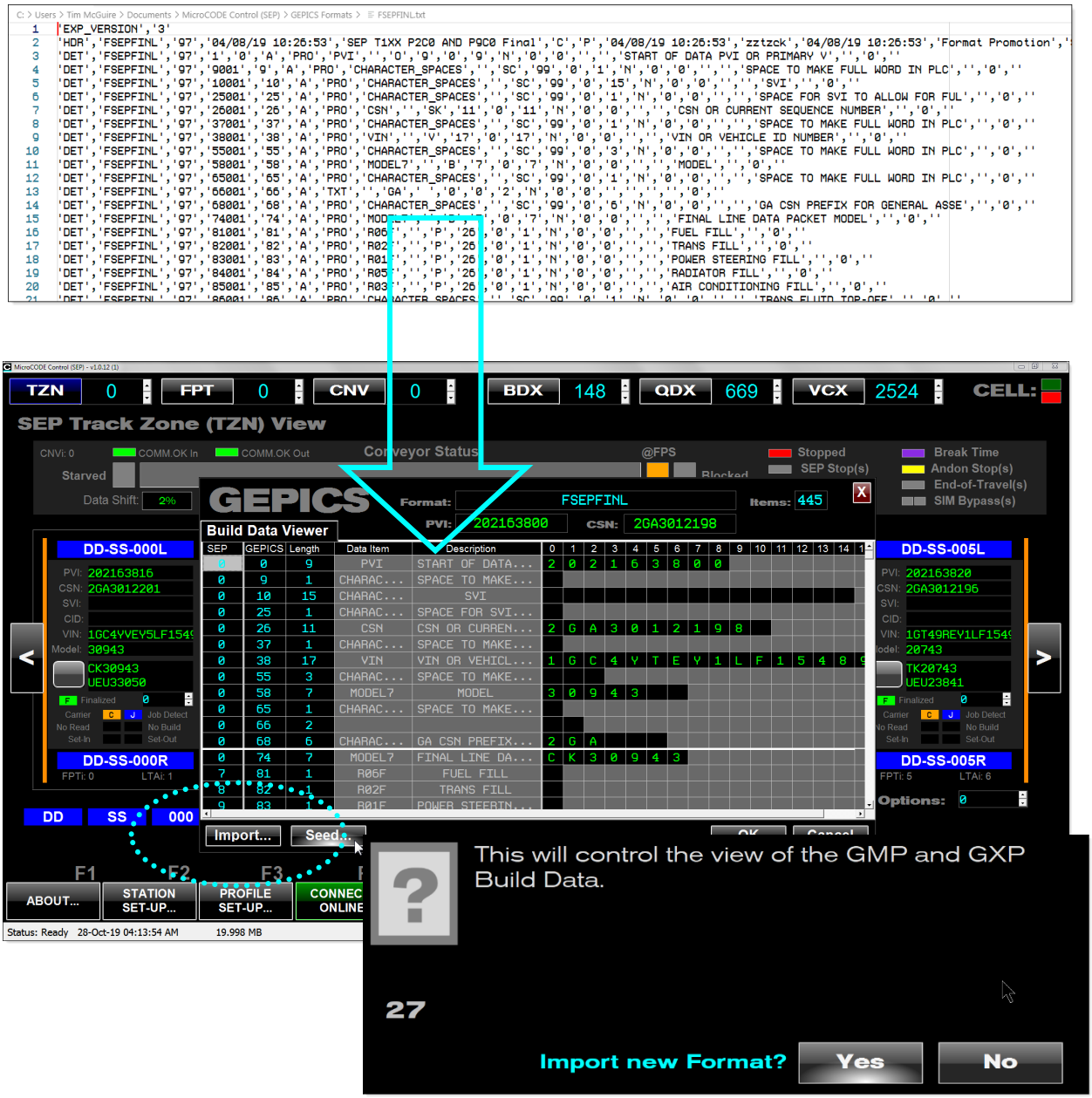


Using a GEPICS FORMAT

A GEPICS FORMAT is a data definition file that describes the source and layout of a Vehicle Order for the EPP (or other) manufacturing systems.

The GEPICS Format file can be directly exported via email from GEPICS to a User's email address. This file is used by the Control (EPP) App to interpret all Job Build Data read from the EPP PLCs.

Example 5 A GEPICS Format File



Job Control Profiles (JCP)

The App gives complete control over Model Code, RPO Codes, Process Tool Styles, anything in the GEPICS Build Data Packet.

HEADER Changes
Vehicle ID and Model changes

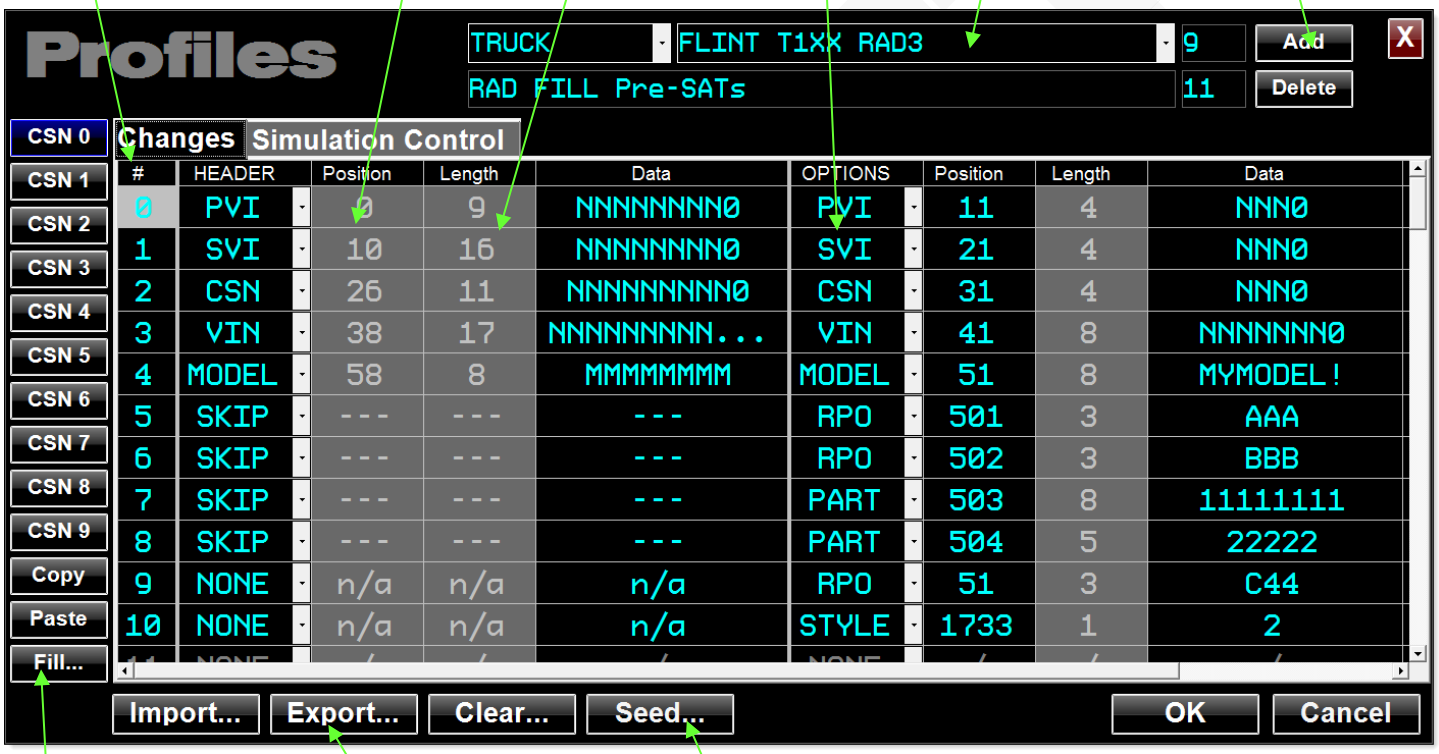
OPTION Data
Autogenerated from the seed Job and this pattern

PROFILE Type, Name and **Description**
Up to **100** Profiles—each with a unique set of 10 Jobs (which of each can have 100 changes).

Change Index
Up to **100** changes per CSN Sequence #

HEADER (Fixed)
Header data location and size are not changeable

Add and **Remove PROFILEs**
Up to **100** Profiles are available at any time.



CSN Sequence
Up to **10** unique Jobs in constant rotation

Import and **Export PROFILEs**
Take any Profile out to a text file that can be shared with other Users

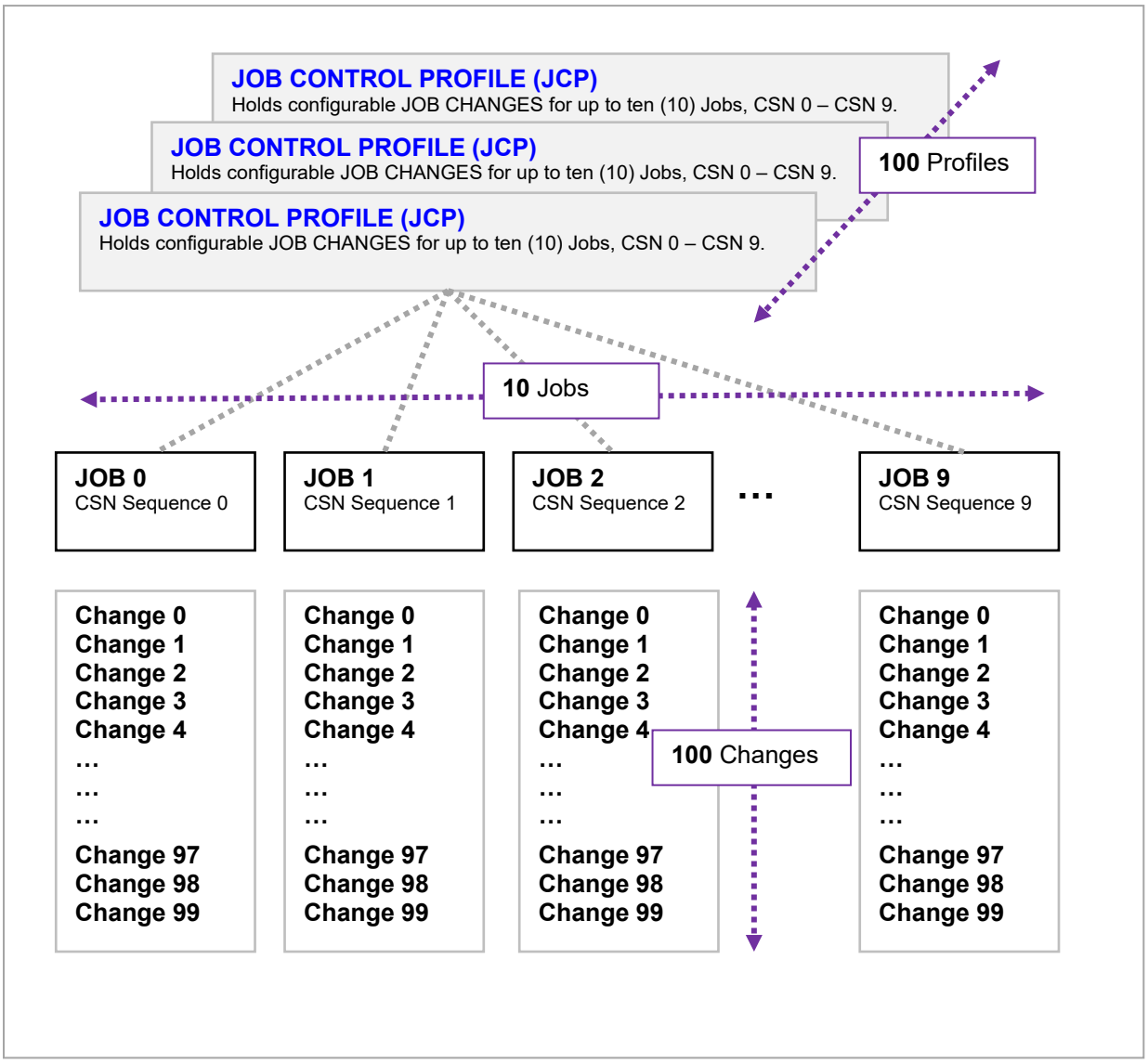
GEPICS Reference
Open a window into the GEPICS 'Seed Job' data for reference while configuring your simulation.

MicroCODE Control (EPP) – Job Control Profiles

Let's look at the configuration design underlaying the Job Control Profiles.

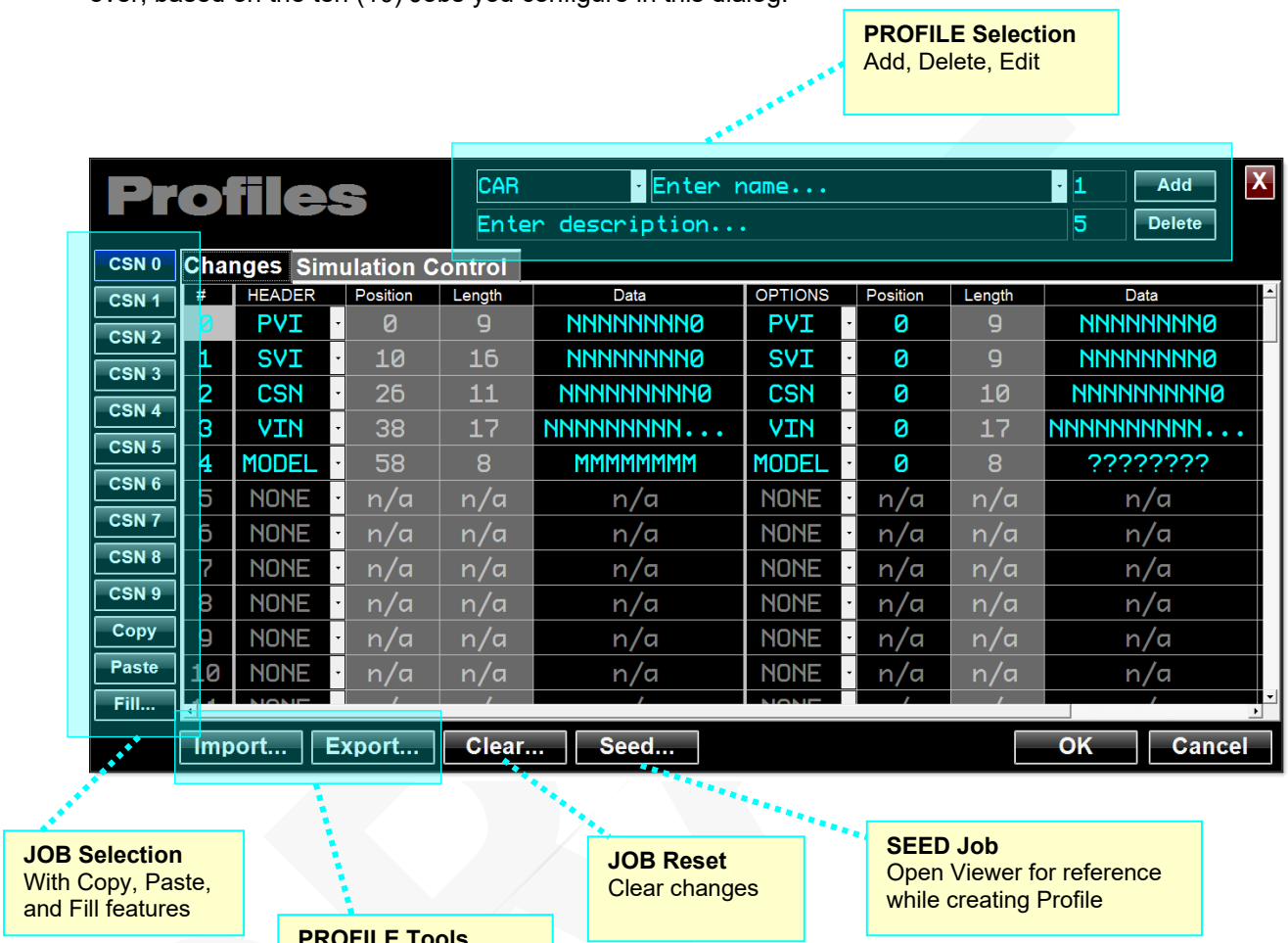
The App is capable of holding 100 (Profiles) x 10 (Jobs) x 100 (Changes) = (100,000) Changes for generating simulated orders. Profiles can be imported and exported and are simple ASCII Text files.

Example 6 Job Profiles MicroCODE Control (EPP) App Architecture



Controlling Job Rotation

The App allows you to control the option content of a job generated during simulation based on the last digit of its CSN (0-9). The 'CSN' buttons down the left of the Job Control Profile (JCP) dialog box are used to configure the 'Changes' you want made to the Jobs. These changes will repeat, over and over, based on the ten (10) Jobs you configure in this dialog.



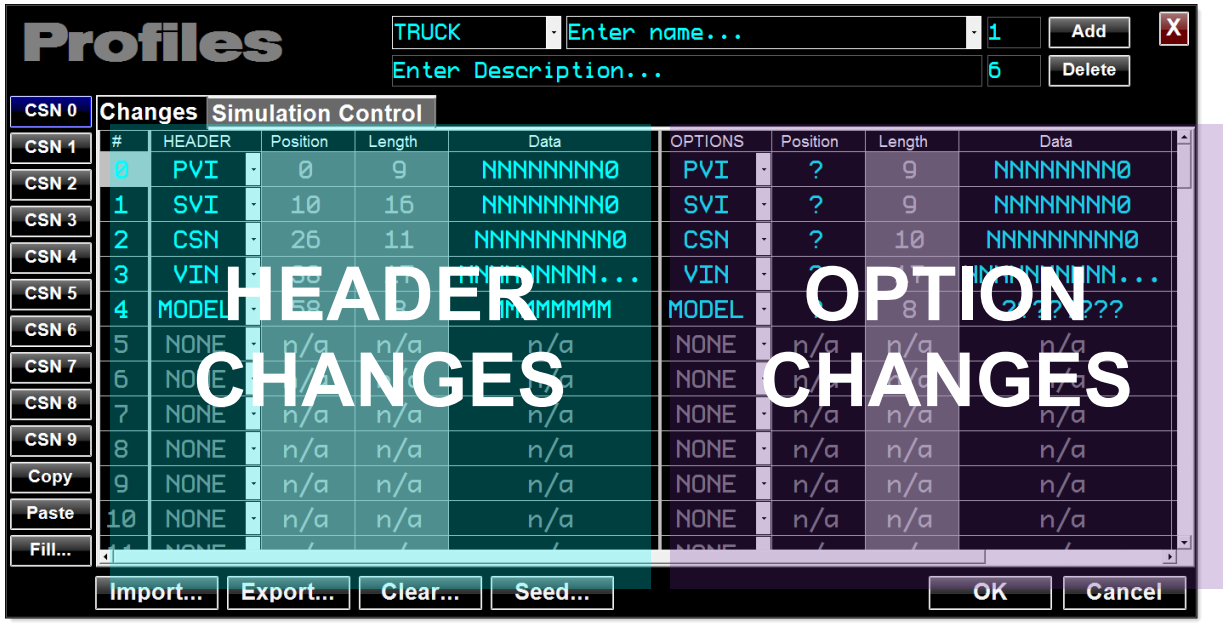
5.1 PROFILE Job Data Changes

These are the options that control the generation of simulated Jobs at the beginning of a Track Zone.

The changes are broken into two (2) sections: the HEADER and the OPTIONS.

The **HEADER** is everything in the standard GEPICS Header that identifies the Vehicle Order.

The **OPTIONS** is everything else below the HEADER, as known as the 'Build Data'… these are the options ordered by the customer or generated automatically based on the customers options.



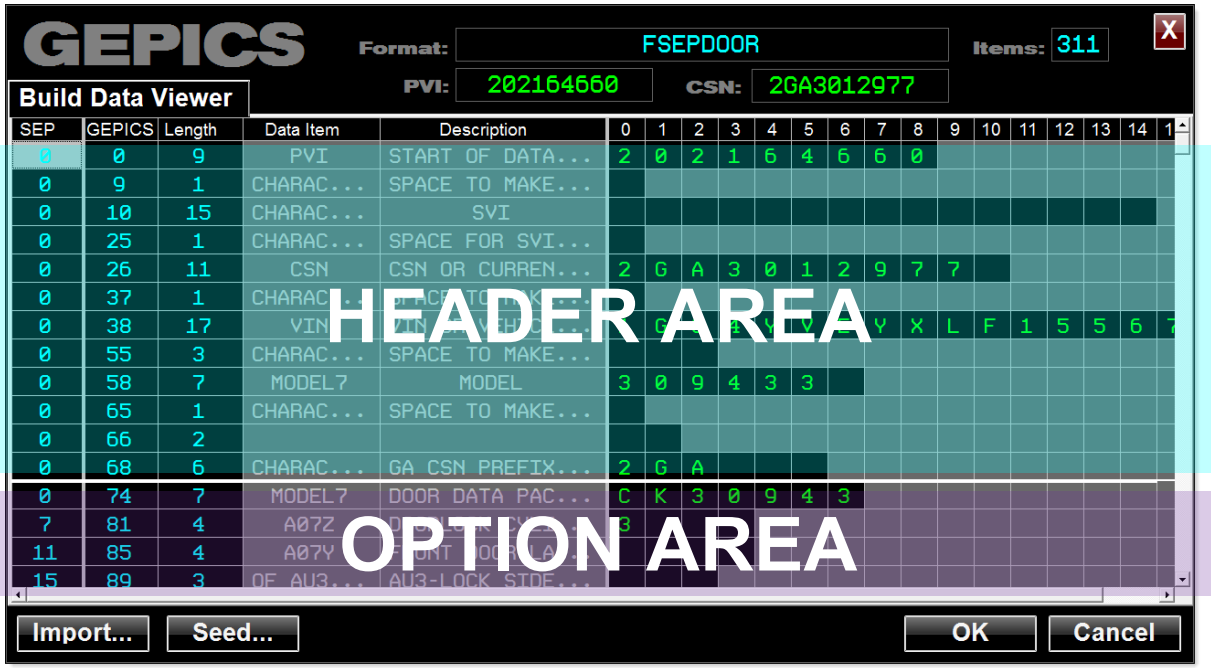
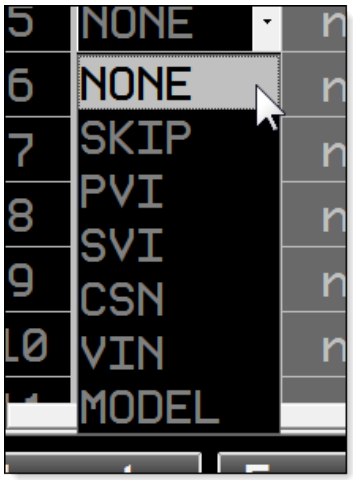


Table 1 HEADER Changes



NONE	Makes no changes to the GEPICS HEADER, if coupled with NONE in OPTIONS, ends all changes to the packet. *
SKIP	Makes no changes to the HEADER, indicate OPTIONS changes are being made.
PVI	**Automatic**. Do not change, this controls the generation of a unique PVI in the HEADER, based on the CSN Sequence #.
SVI	**Automatic**. Do not change, this controls the generation of a unique SVI in the HEADER, based on the CSN Sequence #.
CSN	**Automatic**. Do not change, this controls the generation of a unique CSN in the HEADER, based on the CSN Sequence #.
VIN	**Automatic**. Do not change, this controls the generation of a unique VIN in the HEADER, based on the CSN Sequence #.
MODEL	Allows you to change the MODEL Number in the Header for testing.

* Caution: The App processes the changes from the top and the first row the has NONE for HEADER changes and NONE for OPTIONS changes is deemed the end of the entire change list.

Table 2 OPTION Changes

NONE	Makes no changes to the GEPICS OPTIONS, if coupled with NONE in HEADER, ends all changes to the packet.
SKIP	Makes no changes to the HEADER, indicate OPTIONS changes are being made.
PVI	**Optional**. If your SAT refers to PVI in the 'Build Data' area you need to edit this change to enter the EPP offset where it's needed, this will place a copy of the PVI there (based on the CSN Sequence #) and its length will be based on the length of the NNNN field you enter.
SVI	**Optional**. If your SAT refers to SVI in the 'Build Data' area you need to edit this change to enter the EPP offset where it's needed, this will place a copy of the SVI there (based on the CSN Sequence #) and its length will be based on the length of the NNNN field you enter.
CSN	**Optional**. If your SAT refers to CSN in the 'Build Data' area you need to edit this change to enter the EPP offset where it's needed, this will place a copy of the CSN there (based on the CSN Sequence #) and its length will be based on the length of the NNNN field you enter.
VIN	**Optional**. If your SAT refers to VIN in the 'Build Data' area you need to edit this change to enter the EPP offset where it's needed, this will place a copy of the VIN there (based on the CSN Sequence #) and its length will be based on the length of the NNNN field you enter.

MODEL

Optional. If your SAT refers to MODEL CODE in the 'Build Data' area you need to edit this change to enter the EPP offset where it's needed and enter the MODEL CODE, that you want to test.

RPO

Optional. If your SAT refers to RPO CODES in the 'Build Data' area you need to edit this change to enter the EPP offset where it's needed and enter the RPO CODE, you want to test. You can add as many of these as needed to create the Vehicle Order that you want to test. (The only limit is 100 Changes—of any type—to a particular Order).

PART

Optional. If your SAT refers to PART NUMBERS in the 'Build Data' area you need to edit this change to enter the EPP offset where it's needed and enter the PART NUMBER, you want to test. You can add as many of these as needed to create the Vehicle Order that you want to test. (The only limit is 100 Changes—of any type—to a particular Order).

VPPS

Optional. If your SAT refers to a VEHICLE PART POSITION SYSTEM (VPPS) value in the 'Build Data' area you need to edit this change to enter the EPP offset where it's needed and enter the VPPS value, that you want to test.

LOCAL

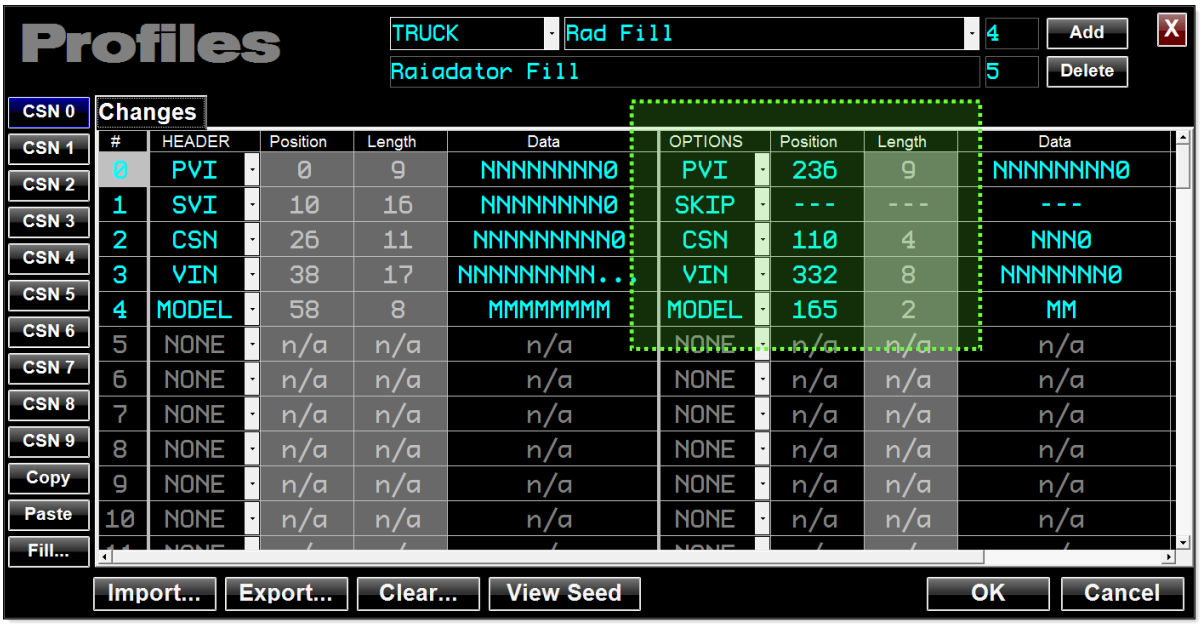
Optional. If your SAT refers to LOCAL BROADCAST CODES in the 'Build Data' area you need to edit this change to enter the EPP offset where it's needed and enter the LOCAL BROADCAST CODE, that you want to test.

STYLE

Optional. If your SAT refers to a PROCESS TOOL STYLE # in the 'Build Data' area you need to edit this change to enter the EPP offset where it's needed and enter the STYLE NUMBER, that you want to test.

Auto-Configuration of Vehicle ID positions within the Build Data Packet

The App now uses the GEPICS Format you have selected to 'Auto-Complete' the positions and Lengths of the Vehicle Identifiers if they are echoed into the OPTIONS area of your Build Data Packet.



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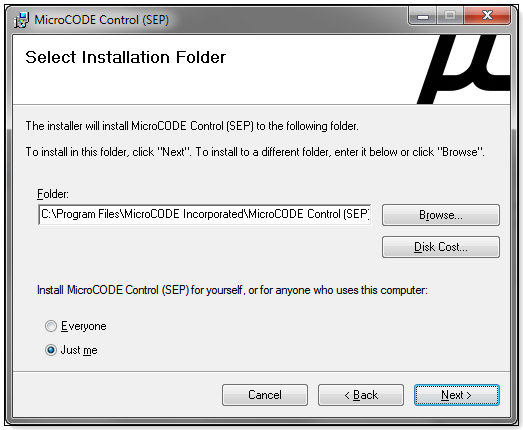
6 Running System Acceptance Tests (SATs)

Once you have the EPP Hardware environment set-up, and laptops available for the MicroCODE Control (EPP) App, you're ready to run a simulation of GEPICS Jobs to test your configured Actions.

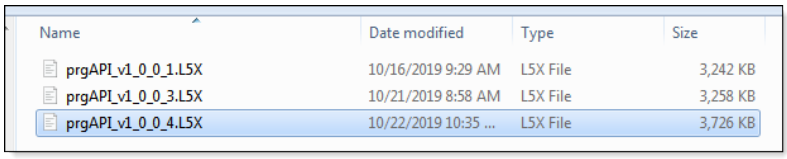
Workflow

Step 1: Install the **MicroCODE Control for EPP** App (**MicroCODE Control (EPP).exe**) on the Windows PC that will control the SAT environment for each Track Zone.

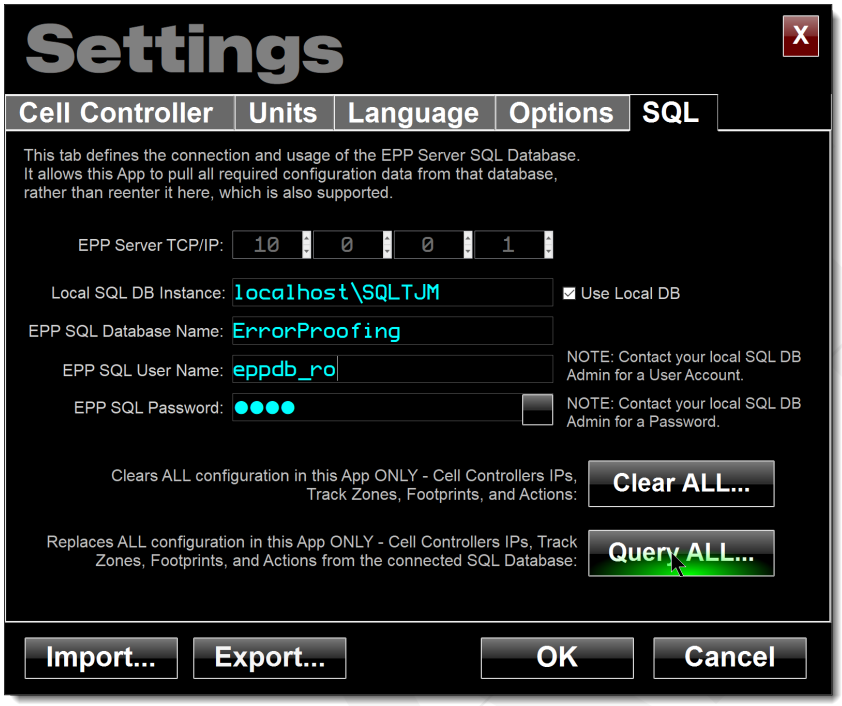


Step 2: Import the **MicroCODE API for EPP** Program (**prgAPI**) into the EPP Cell Controller that controls the Zone where SATs are to be performed.

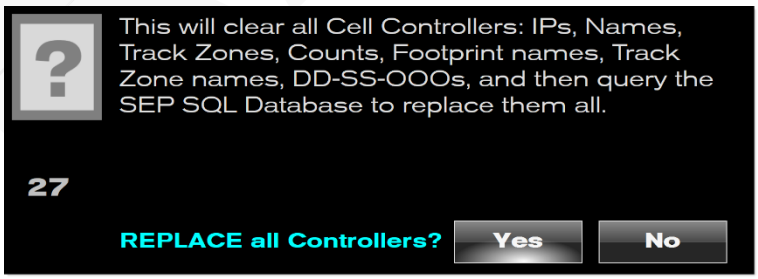
NOTE: Import the version that was installed with your Control App.



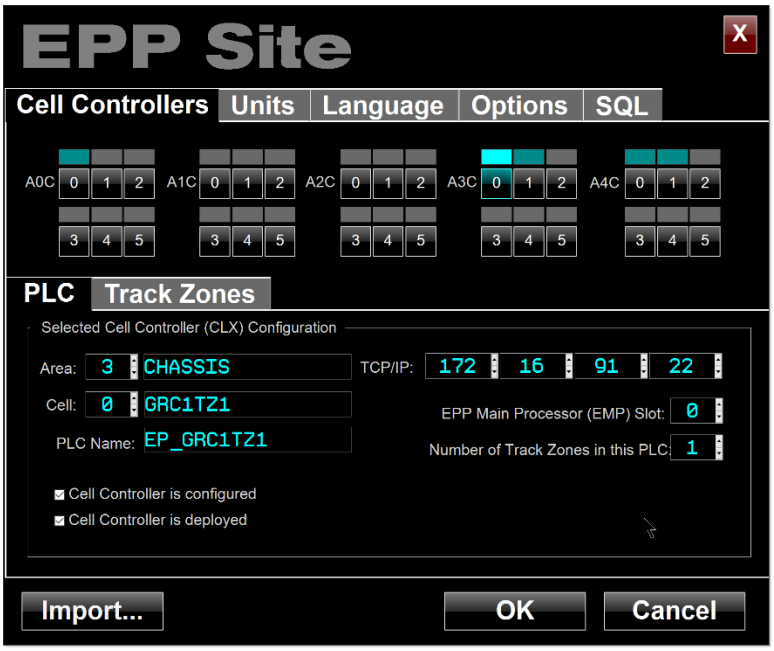
Step 3: Using **[F2 SITE SET-UP]** Configure a connection from the App to the EPP SQL Database from within the App itself.



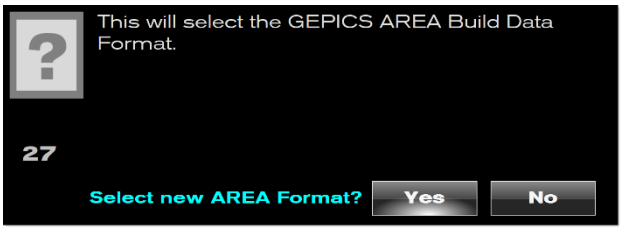
Step 3a: Using **[F2 SITE SET-UP]** select "Query All…" to pull all the Tracking and Cell Controller communication from the EPP SQL Database.

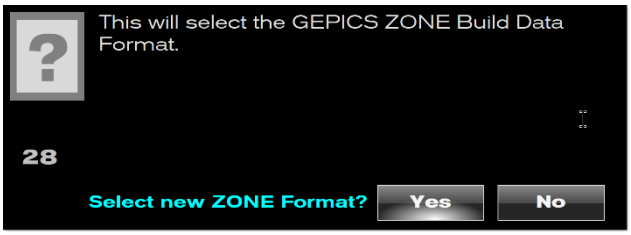


Step 3b: Using **[F2 SITE SET-UP]** on the "Cell Controllers" tab verify the Ethernet Card address matches your test environment and that the Cell is marked **Configured and Deployed.**
NOTE: The App will not connect to any PLC that is not marked 'Deployed'.

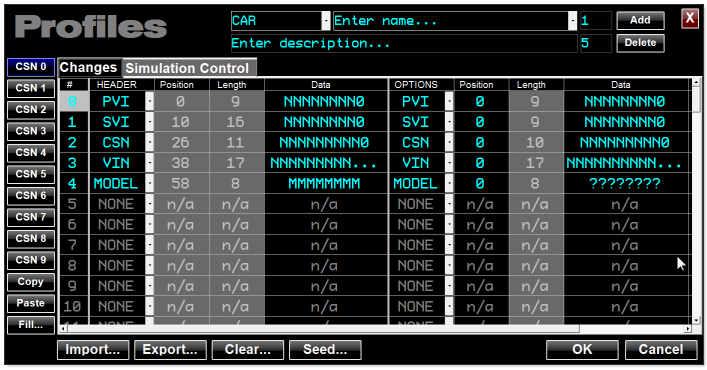


Step 3c: While still in **[F2 SITE SET-UP]** on the **[Track Zones]** tab, select the GEPICS Format associated with this Cell Controller.



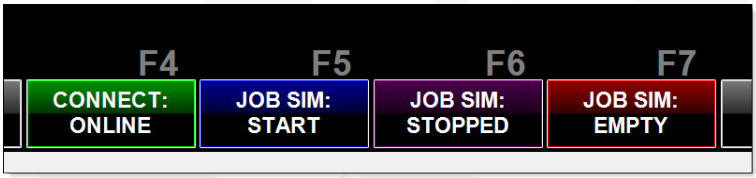


Step 4: Using **[F3 PROFILE SET-UP]** Configure—or import—Job Control Profile(s) (JCP) that represents the GEPICS Build Data changes you need in the Job rotation to exercise all TASKs and the Behaviors you are SAT'ing.

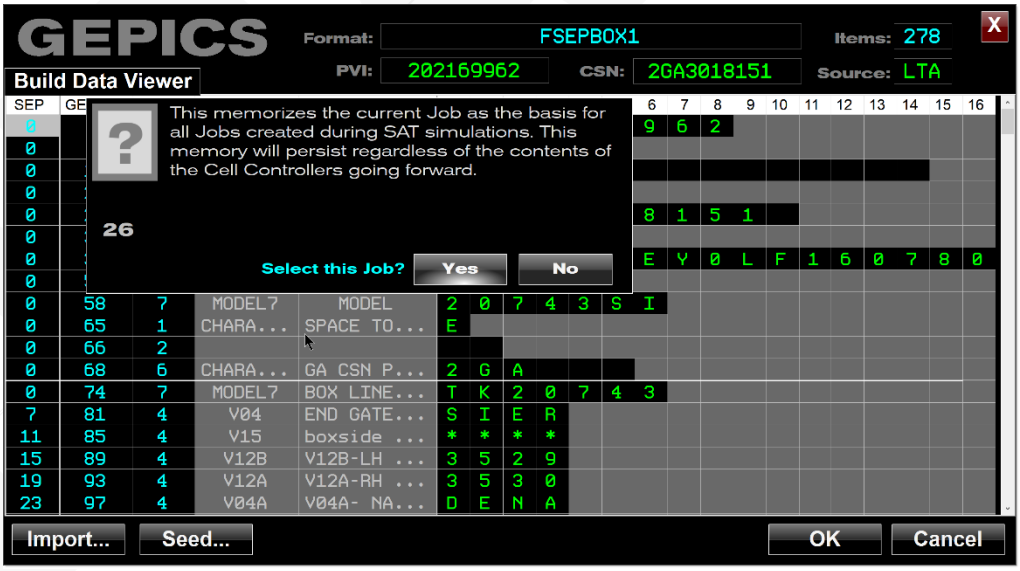


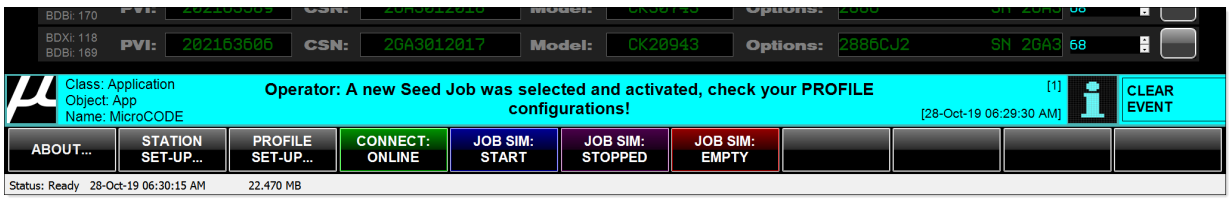
> **NOTE:** It may be better to do this after you have been connected to the Cell Controller and selected a SEED JOB that you can refer to while creating your Profiles, unless you have very good documentation about what must be changed in the GEPICS Packet for your SATs.

Step 5: Using **[F4 CONNECT:]** Connect to the EPP Cell Controller.



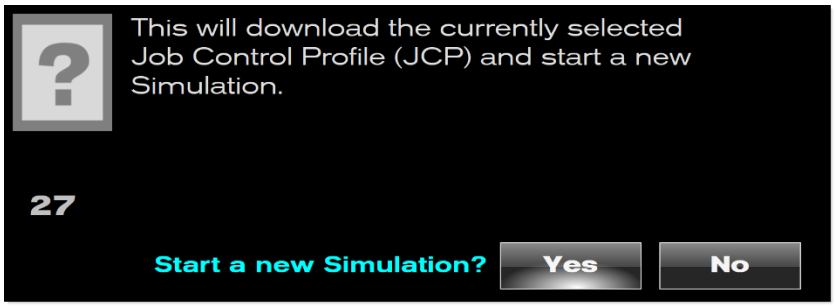
Step 6: Using the **[BDX]** Screen Button, select a 'Seed' Job from the EPP PLC GEPICS Buffer by right-clicking on the Job in the Buffer and selecting "**Make this the Seed Job**".





Step 7: Using the **[TZN]** Screen Button, select the Track Zone within the EPP PLC that will receive the simulated Job Flow with the Conveyor simulation.

Step 8: Using **[F5 SIM:]** start the simulated Job Flow. This can be seen as long as the Screen in in the [TZN] View. You can return to the [TZN] view by clicking the [TZN] button at any time.

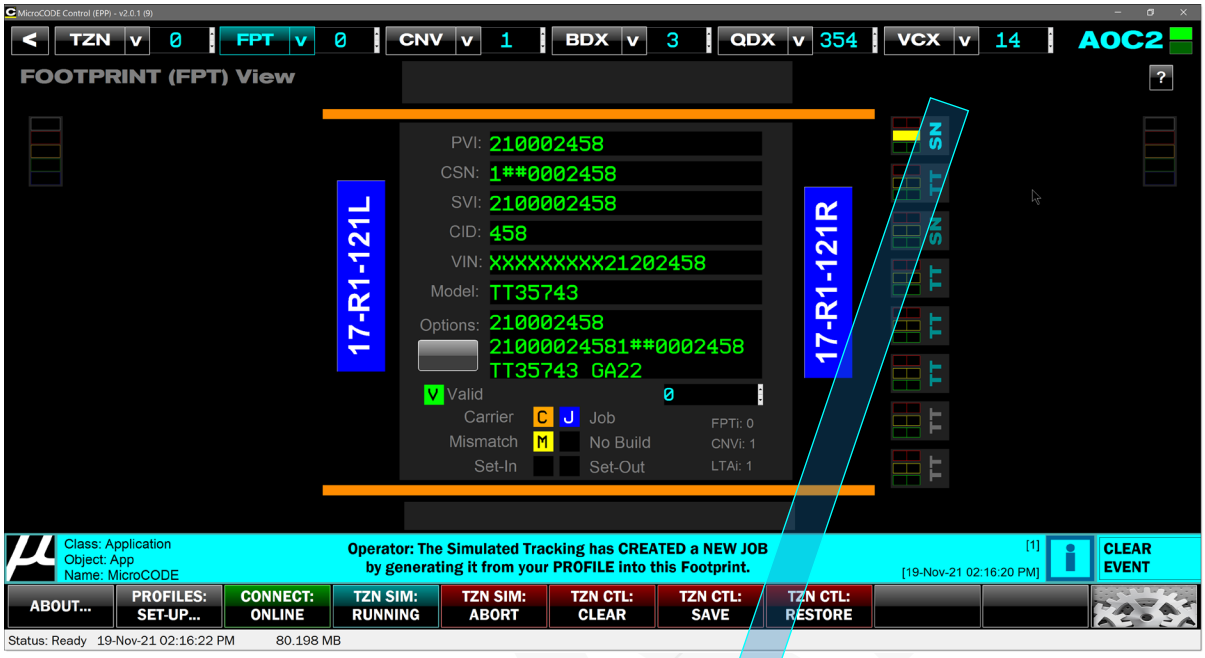


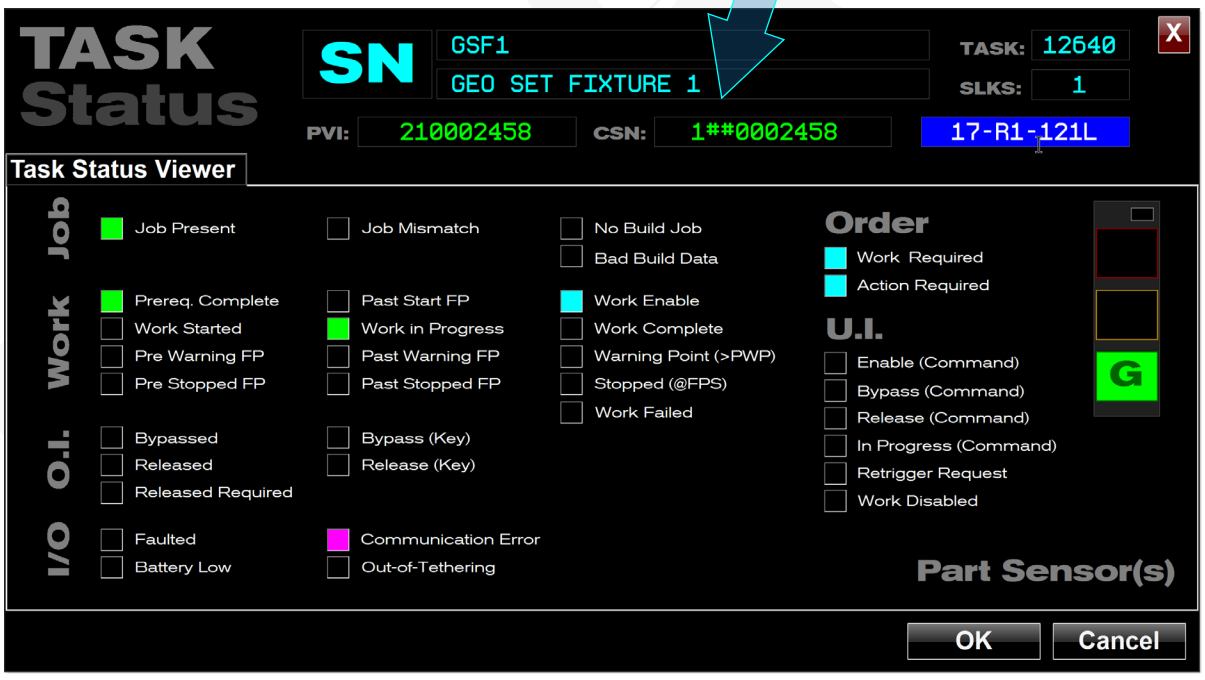
Step 9: Use **[F5 SIM: ABORT]** to end the simulation at any time.

Use **the Conveyor Control Buttons** to stop and start the simulated Conveyor.

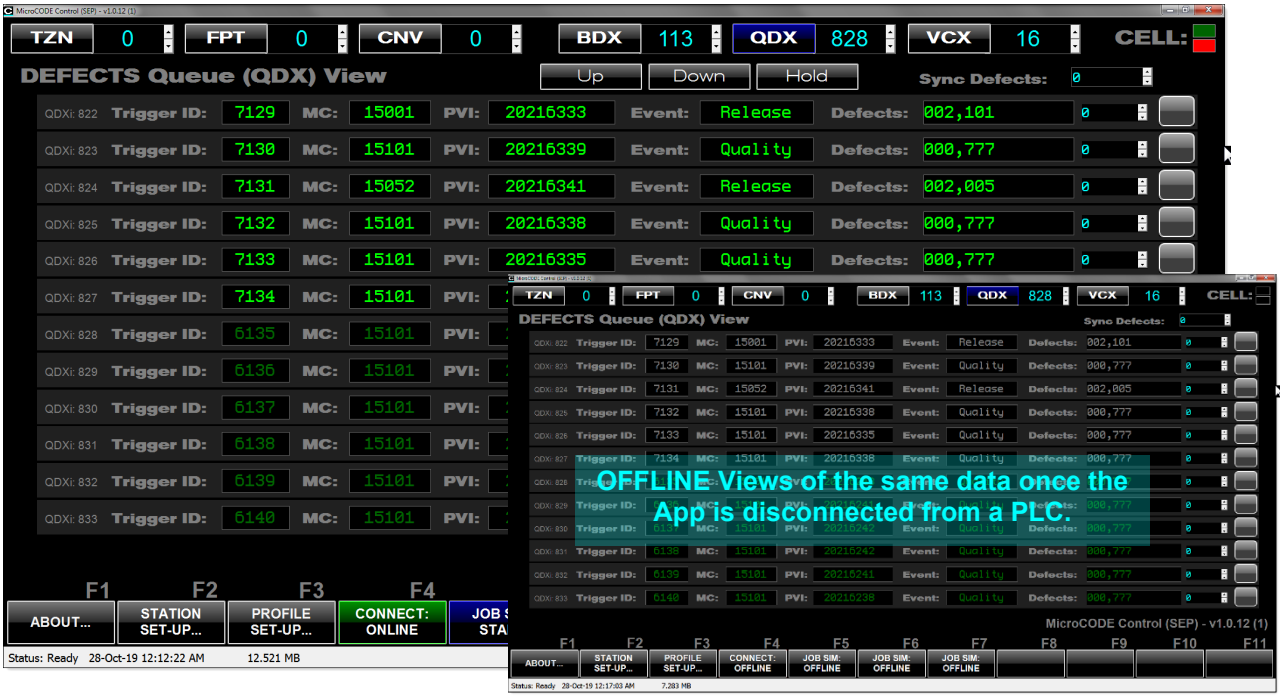
Step 10: Perform your SAT with the actual hardware.
(See SAT Forms for detailed instructions).

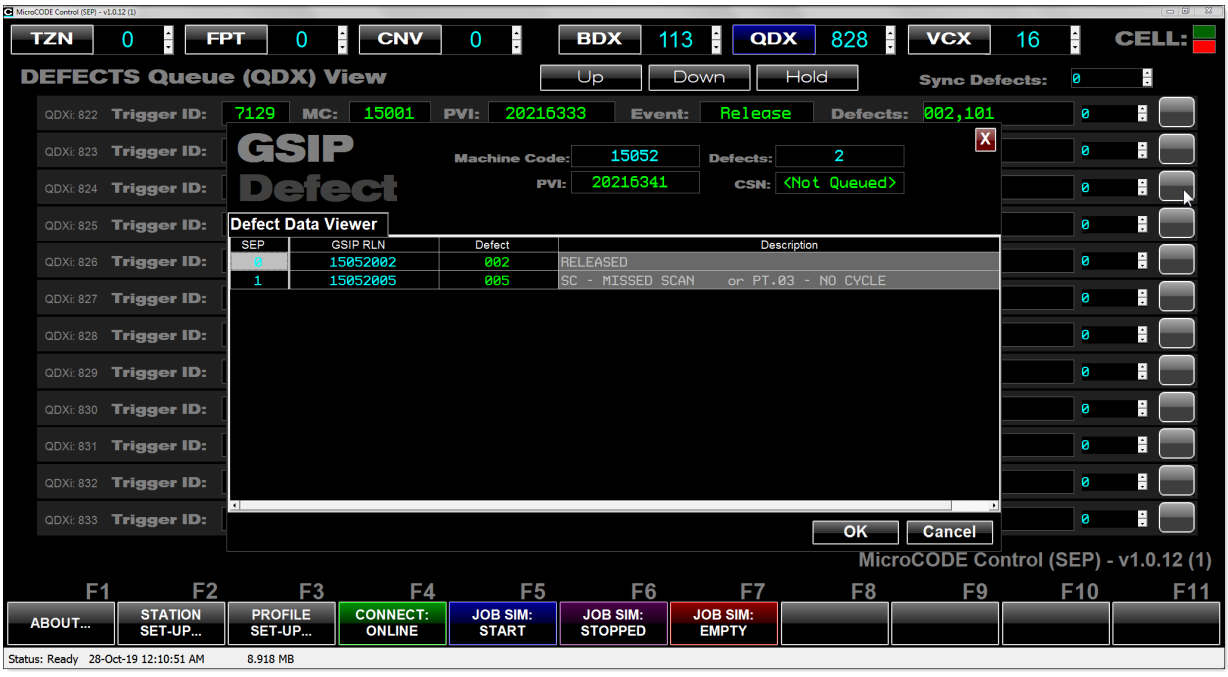
Use the Footprint View to monitor the state of your Tasks as they are executed.
Clicking on a Task opens the detailed TASK Status dialog.



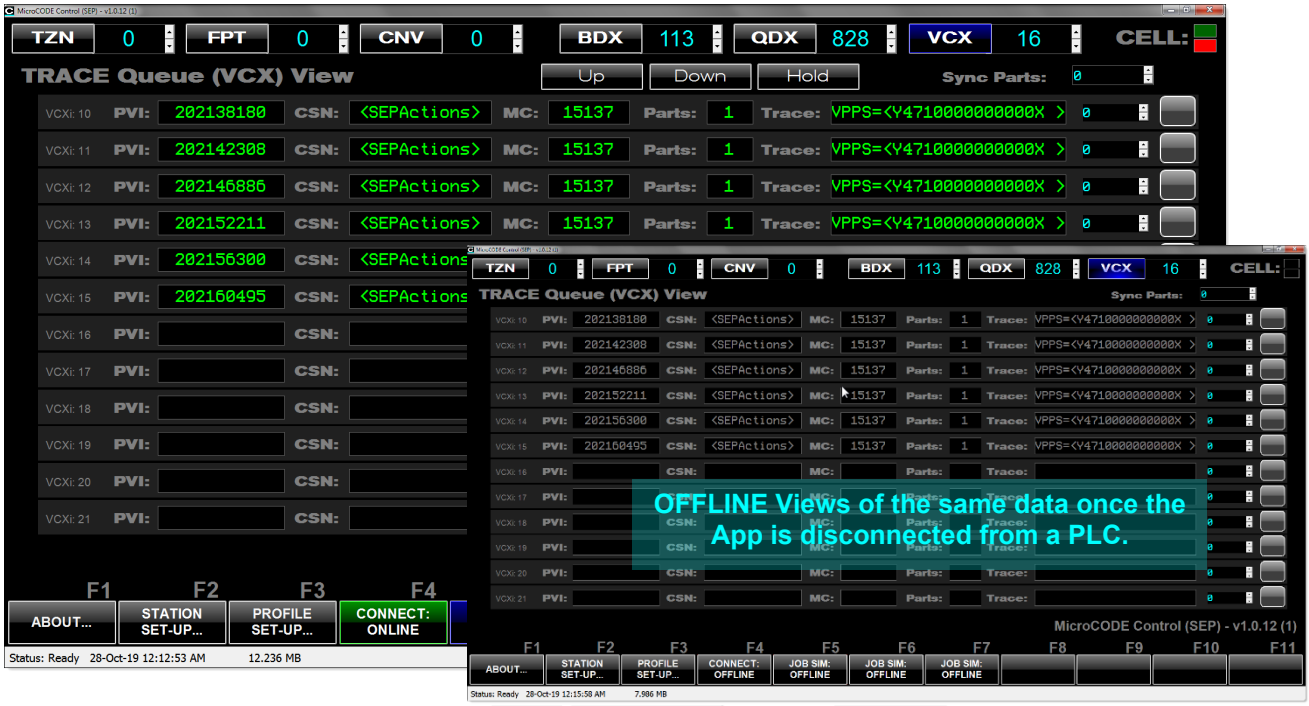


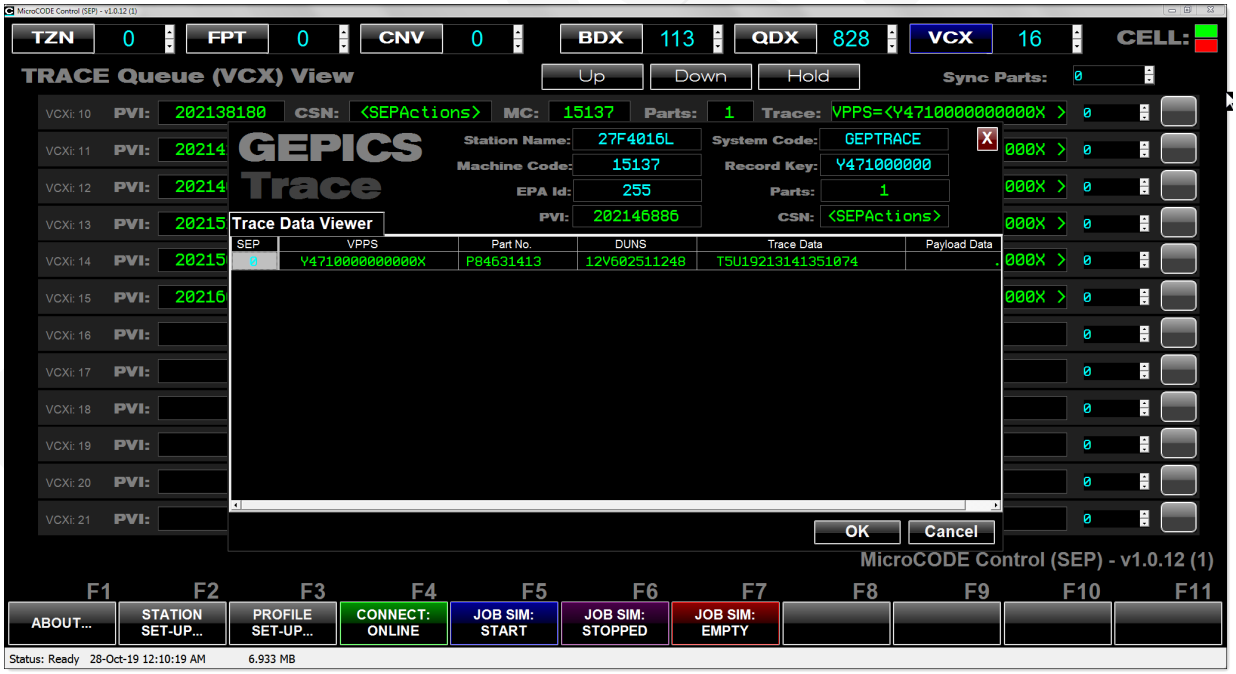
Step 11: Use the QDX Defect Viewer to ensure all required Defects were generated and placed in the EPP PLC's queue.



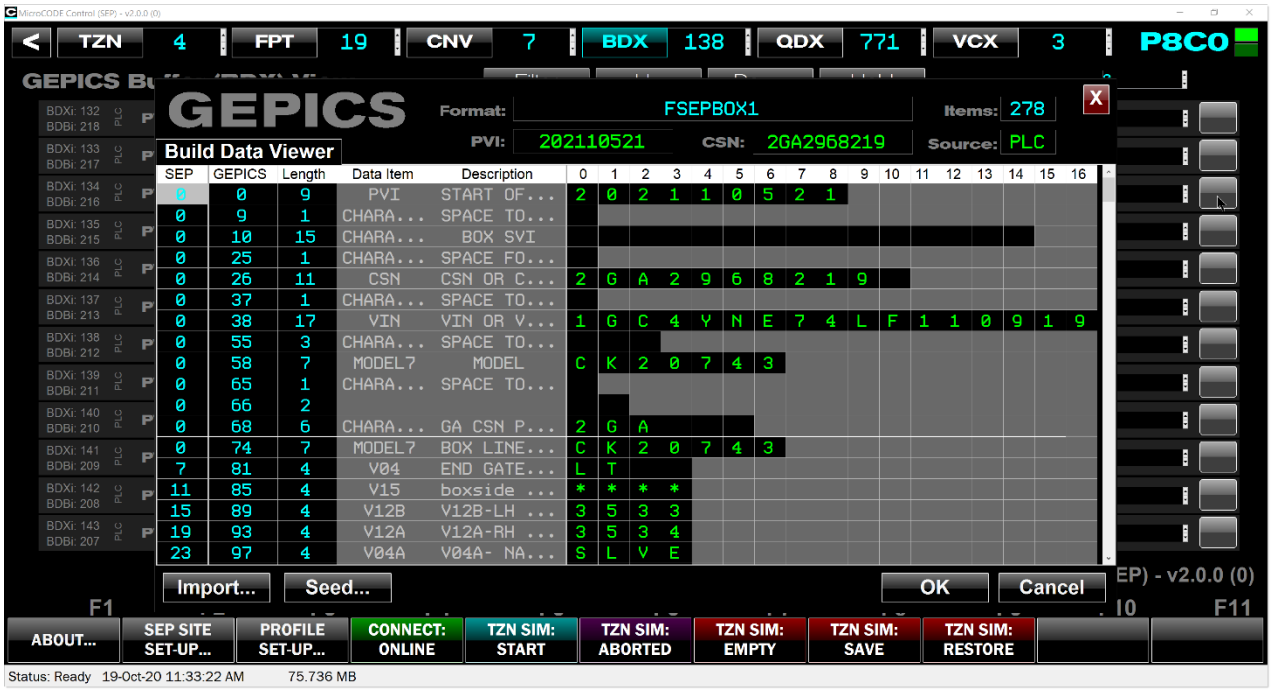


Step 12: Use the VCX Trace Viewer to ensure all required Trace data was generated and placed in the EPP PLC's queue.





Step 13: Use the BDX Buffer View to double check the Seed Job configuration…



6.1 Handling the Simulated Conveyor

Once a Simulation is started on a Track Zone several things happen:

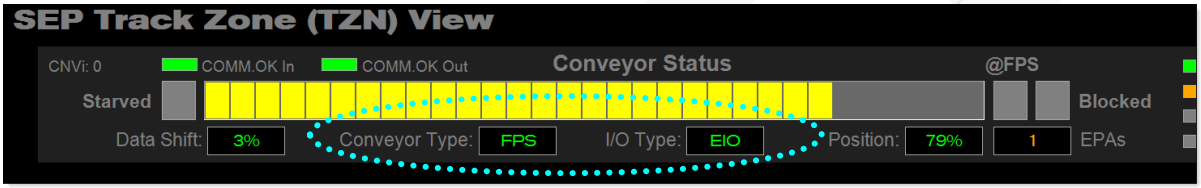
1) The Conveyor's real-world communication set-up is saved.

2) The Conveyor is converted to a 'Simulated Conveyor'.

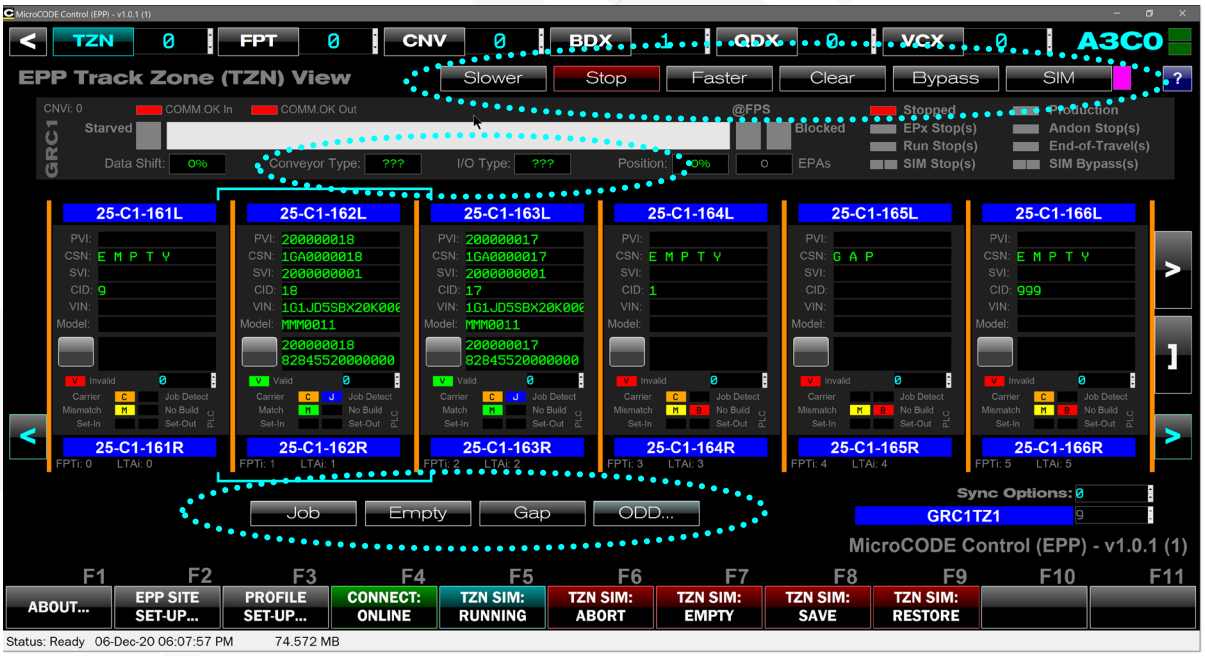
3) The 'Simulated Conveyor' is set to a 'Stopped' condition, to allow the User to 'Save' the current Track Zone's tracking image before any movement begins.

4) The active PROFILE is used to generate GEPICS JOBs at the start of the Track Zone, like an LTC.

You can see the conversion of the Conveyor by watching the TYPE and I/O indicators:



Once in SIMULATION MODE, the Type and I/O read **SIM**, and all the controls appear to control the simulated Conveyor. **NOTE: The Conveyor has a 'SIM Stop' on by default.**



6.2 Simulator Conveyor Commands

These are the commands that appear on the Track Zone Screen once a simulation is in process. They are hidden when in 'Viewer' mode.

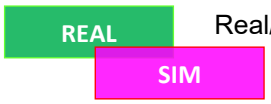
Decreases Conveyor Speed

Increased Conveyor Speed

Acts like a Production Run/Stop, this button changes state and acts as a toggle.

Removes all EPP Andon Stop Requests from the Conveyor, allowing it to proceed.

Passed the Conveyor in 'Bypass SEP' mode, nothing will stop it.



Real/Simulated, this button changes Simulation state and acts as a toggle.

Clears the current Footprint in the Track Zone display*
And allows the next simulated JOB to be generated.
NOTE: You may see "READY" displayed in the Footprint right after it is cleared and before the next Job is generated, this is normal.

Causes the EPP PLC to restart work on the JOB in the currently selected Footprint. This only work when there is a JOB in the Footprint.

Converts the Job in the current Footprint in the Track Zone display*
into an EMPTY CARRIER.

Converts the Job in the current Footprint of the Track Zone display*
into a GAP.

Fills the Track Zone with simulated jobs starting at the current Footprint*
and working backward to the first Footprint, using the simulator's generated Jobs.

* **NOTE:** The JOB, EMPTY, GAP and REBUILD commands are based on the currently selected Footprint and **not** the beginning of the Track Zone. So, if you scroll down the Track Zone and click **[Empty]** you will get an empty where the 'Job Focus' is located, not necessarily where you are looking.

The 'Job Focus' is indicated by the Cyan Cursor around the Footprint.

You can move the 'Job Focus' in three (3) ways:

1) Click on the desired Footprint.
2) Use the Left/Right Cyan Arrow buttons on the screen.
3) Use the Left/Right Arrow Keys on the keyboard.

6.3 App vs. EPP PLC – Span of Simulation Control

The MicroCODE Control (EPP) App is designed to work hand-in-hand with the existing Conveyor Simulation code in the EPP PLC.

- The **Simulated Jobs** are controlled by this App and are created only while it is connected to the EPP Cell Controller as the 'Owner/Generator'.

- The **Simulated Conveyor** is controlled by the EPP PLC code, and that code is fed commands from this App indirectly through the new **prgAPI** that is added to the standard EPP PLC code.

This has several implications that Users must be aware of:

- Once started the **Simulated Conveyor** runs until one of the following happen:

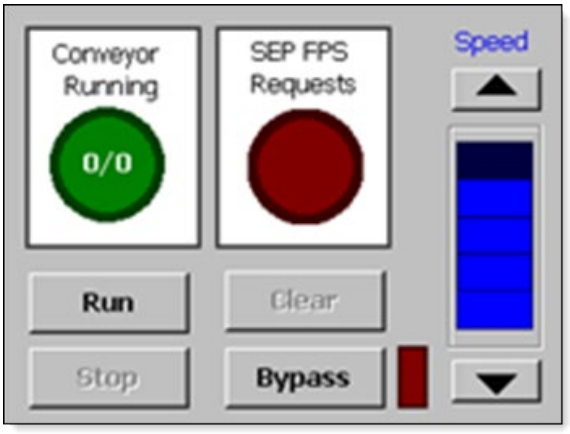
  - TASKs use Andon Requests to stop it
  - It is paused by the MicroCODE Control App controls
  - It is paused by the original EPP Control Simulator controls
  - It is paused by the MicroCODE Process Tool monitoring tool

- The Simulated Conveyor does **not** need this App to run, once started it continues even if the App that started it is disconnected.

The Simulated Conveyor can also be made to ignore all Stop Requests by being put in BYPASS Error Proofing Mode (similar to the real-world Conveyor systems). This is accomplished in several ways:

- The SIM BYPASS Command in this App
- The BYPASS Command in the original EPP Control Simulator controls
- By the SIM CLEAR Command in the App (Bypasses Stop Requests for one Job)
- By the CLEAR Command in the original EPP Control Simulator controls

Figure 8 The original Simulated Conveyor Controls (VB App)



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7 App Shortcuts and Special Features

This section covers some items that the App is capable of that are not obvious to first time users.

Finding an RPO Code or Part Number in a GEPICS Order

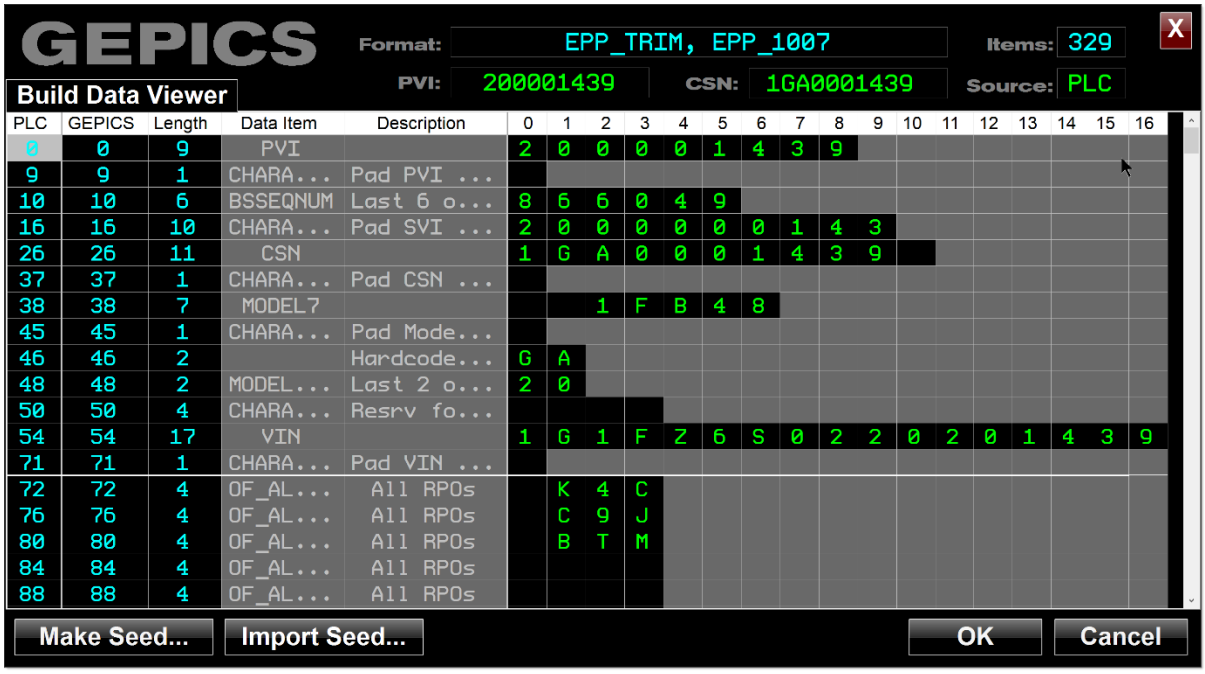
A command task when configuring new Error Proofing Actions and supporting Production is to locate a specific Vehicle Option (RPO or Part Number) within a GEPICS Order.

This can be accomplished very quickly using the Control App with a live EPP PLC connection.

STEP 1: Connect to a Cell Controller.

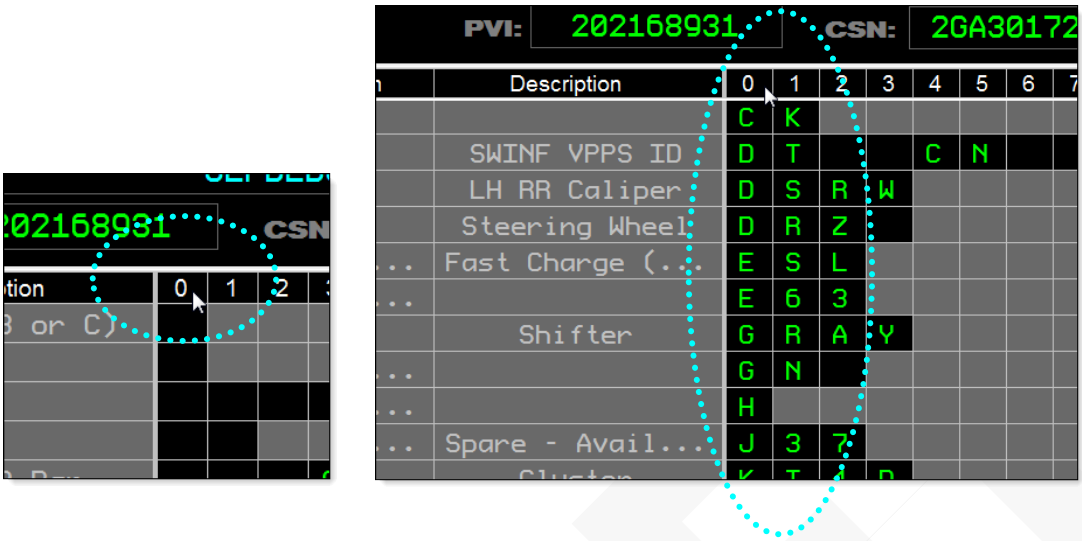
STEP 2: Get to the Vehicle Order you want to check, in EPP Tracking, or EPP GEPICS Buffer.

STEP 3: Open the Job in the GEPICS Viewer.



PLC	GEPICS	Length	Data Item	Description	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0	0	9	PVI		2	0	0	0	0	1	4	3	9								
9	9	1	CHARA...	Pad PVI ...																	
10	10	6	BSSEQNUM	Last 6 o...	8	6	6	0	4	9											
16	16	10	CHARA...	Pad SVI ...	2	0	0	0	0	0	0	1	4	3							
26	26	11	CSN		1	G	A	0	0	0	1	4	3	9							
37	37	1	CHARA...	Pad CSN ...																	
38	38	7	MODEL7				1	F	B	4	8										
45	45	1	CHARA...	Pad Mode...																	
46	46	2		Hardcode...	G	A															
48	48	2	MODEL...	Last 2 o...	2	0															
50	50	4	CHARA...	Resrv fo...																	
54	54	17	VIN		1	G	1	F	Z	6	S	0	2	2	0	2	0	1	4	3	9
71	71	1	CHARA...	Pad VIN ...																	
72	72	4	OF_AL...	All RPOs		K	4	C													
76	76	4	OF_AL...	All RPOs		C	9	J													
80	80	4	OF_AL...	All RPOs		B	T	M													
84	84	4	OF_AL...	All RPOs																	
88	88	4	OF_AL...	All RPOs																	

STEP 4: **Sort the GEPICS Data Elements alphabetically by clicking on the first column.**



Using the GEPICS Viewer to guide PROFILE Creation

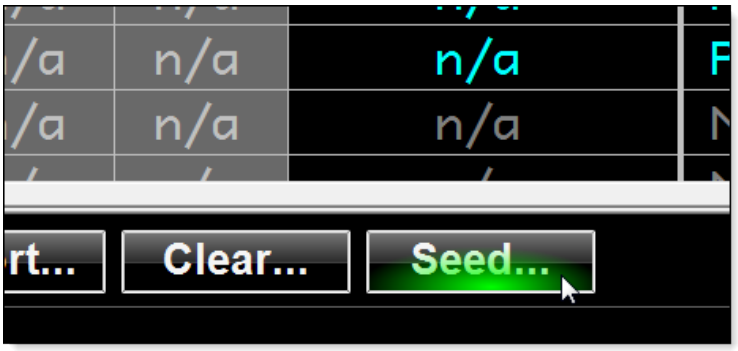
In order to build a good simulation Profile, you will need to refer back to the data layout of your 'Seed' Job'. For that reason, you can open the 'Seed Job' while you are editing a Profile and keep it on another monitor for reference.

We highly recommend you use two (2) monitors for this activity. One for editing the Profile and one for referring to the data layout of your 'Seed Job'.

This can be accomplished very quickly using the Control App with a live EPP PLC connection.

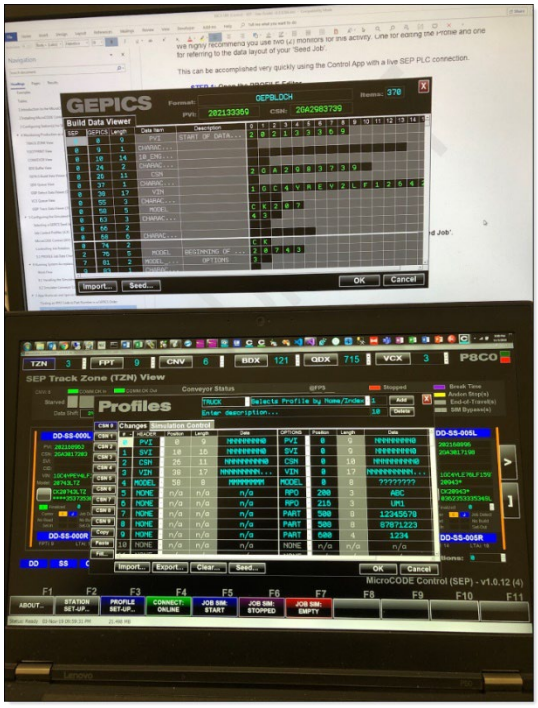
STEP 1: Open the PROFILE Editor.

STEP 2: Click on 'Seed Job…' to open a GEPICS Viewer.



STEP 3: Move the 'Seed Job' View to a second monitor.

STEP 4: Create your changes for ten (10) CSNs while referring to the 'Seed Job'.



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8 Handling App Support and Issue Reporting

It is MicroCODE's intention to move the distribution and updates for the Control Series of Apps to our website. This will happen within the next 6 months as licensing issues are resolved. Until then the Microsoft Installation (**.msi**) file will be distributed via email to registered users.

If you encounter an issue while using a MicroCODE Control App, please follow this procedure:
For immediate assistance call: **855.421.1010**

STEP 1: Gather up the files associated with the issue.

If you are unsure which files to send call us and we'll help determine which will be needed.

- **EPP Programs** – uploaded with data saved.
- **Event Log Files** (.LOG) – located in**…**

```
C:\Users\<user>\Documents\MicroCODE Control (EPP)\Events
```

- **Configuration Files** (.CFG) – located in…

```
C:\Users\<user>\Documents\MicroCODE Control (EPP)\Configuration
```

We may require other files after the initial investigation.

STEP 2: Email MicroCODE with the files attached, as follows:

Attached these files to an email to: **tmcguire@mcode.com**

Subject Line: CONTROL APP – DEFECT REPORT
Email Body:
ISSUE: <Brief Description of the problem including steps to reproduce if possible>
SEVERITY: Choose one, please classify honestly to best utilize our shared resources…

SEV.1 - System crash, complete loss of a major system component
Response Time: No longer than 24 hours.

SEV.2 - Function fails, no work-around is possible, or the App missed identifying a product defect
Response Time: No longer than 48 hours.

SEV.3 - Function fails, work-around is possible, or opening erroneous defects on products
Response Time: No longer than 5 days.

SEV.4 - Function fails, no impact to production, no work-around is necessary, or defect is caused by reconfiguring a Station during production
Response Time: No longer than 15 days.

SEV.5 - Display, Report or Tool problem - no impact on system operation
Response Time: No longer than 30 days.

SEV.6 - Annoyances
Response Time: No longer than 90 days.

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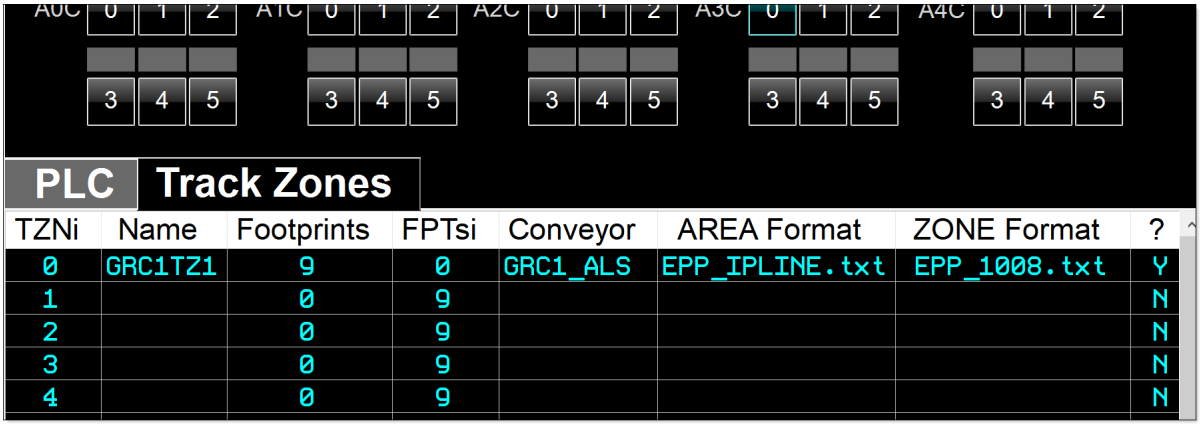
9 Common Issues

This section describes issues seen during app deployments, the usual causes, and normal solutions.

ISSUE 1: Track Zones configured in the EPP Server do not show up in the Control App.

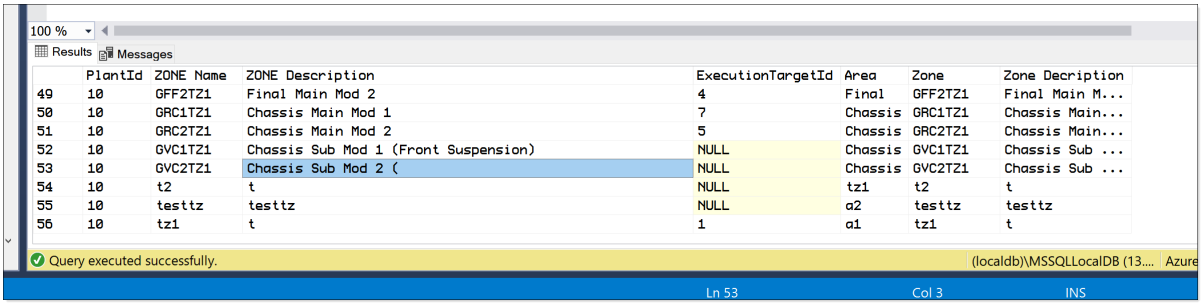
Here the User expected two (2) Track Zones to appear in a selected Cell Controller.



TZNi	Name	Footprints	FPTsi	Conveyor	AREA Format	ZONE Format	?
0	GRC1TZ1	9	0	GRC1_ALS	EPP_IPLINE.txt	EPP_1008.txt	Y
1		0	9				N
2		0	9				N
3		0	9				N
4		0	9				N

Common Cause: The Track Zones are not associated an EPP PLC.

This is seen in the EPP SQL database as shown below… (NULL means not associated with a PLC, in the EPP database “ExecutionTargetId” = EPP PLC).



100 % Results Messages

	PlantId	ZONE Name	ZONE Description	ExecutionTargetId	Area	Zone	Zone Decription
49	10	GFF2TZ1	Final Main Mod 2	4	Final	GFF2TZ1	Final Main M...
50	10	GRC1TZ1	Chassis Main Mod 1	7	Chassis	GRC1TZ1	Chassis Main...
51	10	GRC2TZ1	Chassis Main Mod 2	5	Chassis	GRC2TZ1	Chassis Main...
52	10	GVC1TZ1	Chassis Sub Mod 1 (Front Suspension)	NULL	Chassis	GVC1TZ1	Chassis Sub ...
53	10	GVC2TZ1	Chassis Sub Mod 2 (	NULL	Chassis	GVC2TZ1	Chassis Sub ...
54	10	t2	t	NULL	tz1	t2	t
55	10	testtz	testtz	NULL	a2	testtz	testtz
56	10	tz1	t	1	a1	tz1	t

Query executed successfully. (localdb)\MSSQLLocalDB (13.... Azure

Ln 53 Col 3 INS

SOLUTION: Associate all Track Zones configured in the EPP Server to an EPP PLC.

ISSUE 2: Track Zone Footprints configured in the EPP Server do not show up in the Control App.

Common Cause: The MicroCODE API code in the EPP PLC has not been configured.

Secondary Cause: The MicroCODE API code has not been initialized after import; this only happens on first scan of the PLC logic.

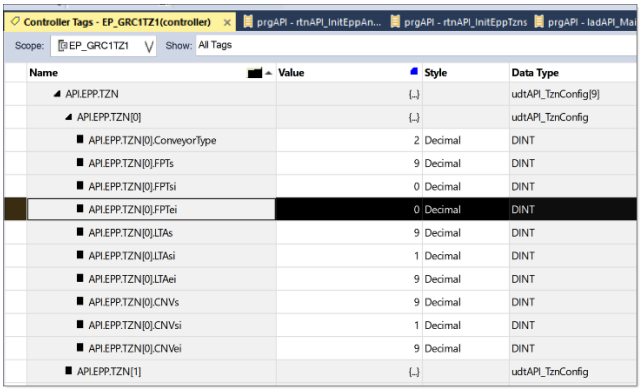
SOLUTION 1: Tailor / Configure the **prgAPI** program in the EPP PLC after importing it from the App install. This is required because the EPP PLC does not contain externally readable configuration data to completely describe what is in the PLC.

e.g.: The number of Conveyor Interface(s) in the EPP PLC is implied by the hard-coded construction of a Produced-Consumed Tag-Pair, and there is no data point to read externally to discern this. So, the **prgAPI** has two (2) routines named: **rtnAPI_CnvInterface_AnCn** and **ladAPI_Configuration_AnCn**.

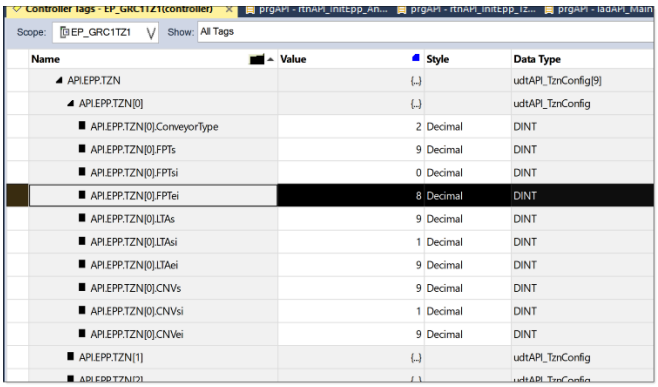
The two routines must be edited/created from the supplied templates to make them specific to an EPP AREA (An) and CELL (Cn), i.e.: **_AnCn** suffix.

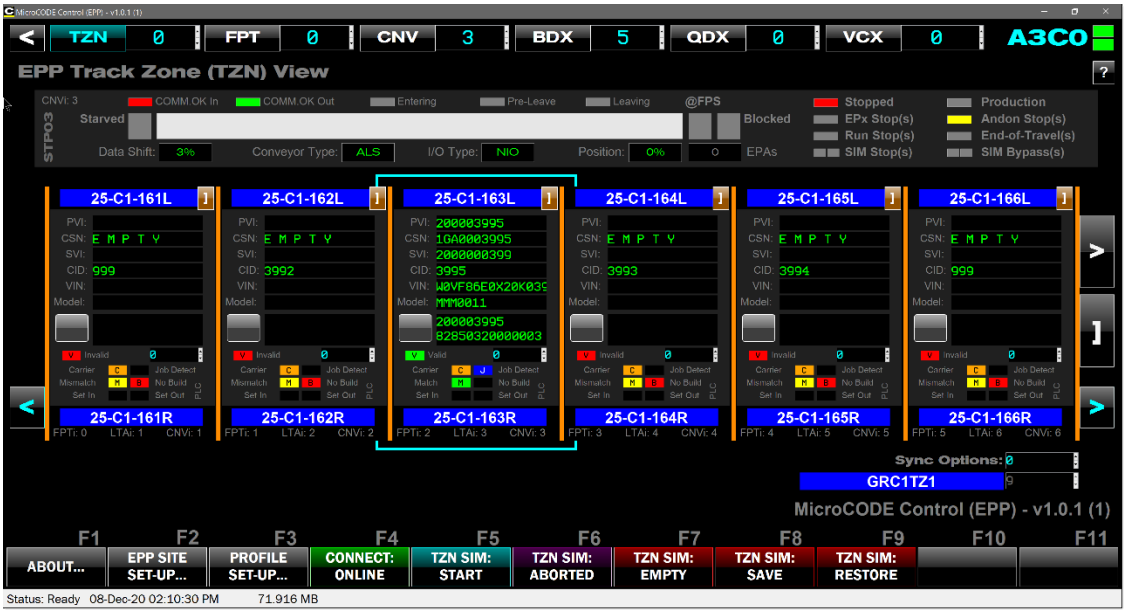
SOLUTION 2: Program/Run cycle the EPP PLC after completing the **_AnCn** routines.

Before initialization, TZNei is 0. This causes the Control App to show no Footprints after the first position, because they are all after the 'Ending Index' of '0'.



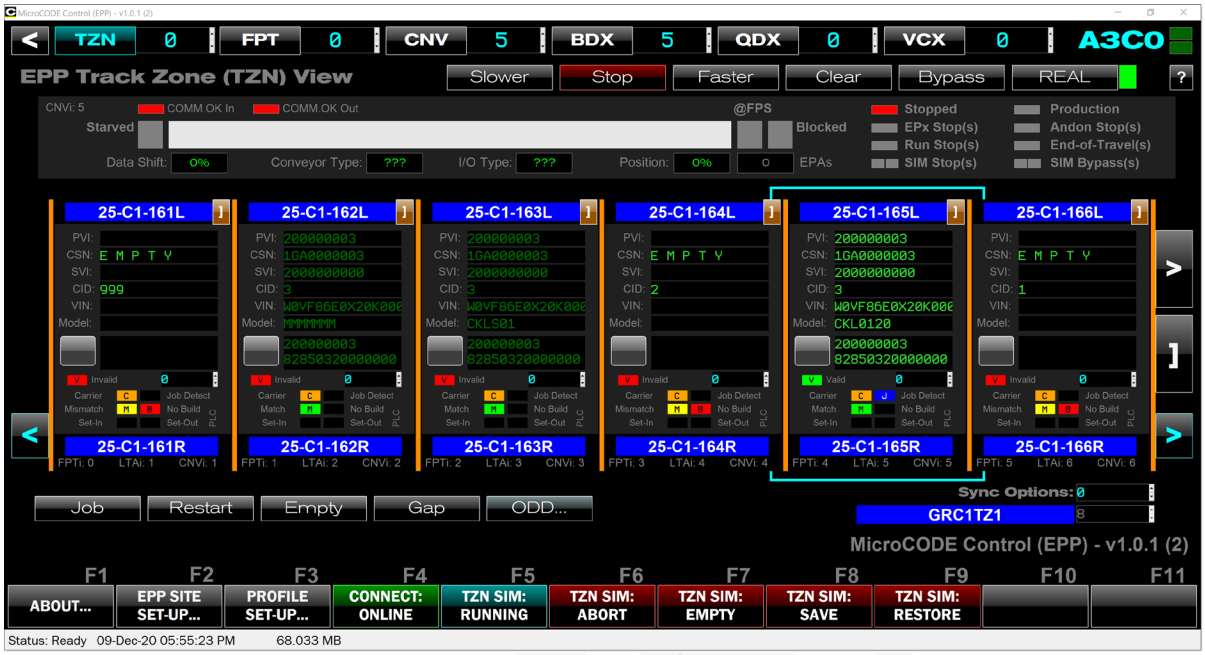
After initialization, FPTei is set to 8, and all Footprint appear.





ISSUE 3: Job generated by the Control App are not activating Error Proofing Actions and show up as 'INVALID' and are dark green in the App display.

In the example below Footprints -162 and -163 are 'invalid' and show up dark green.
And the Job in Footprint -165 is marked 'valid' and is in the normal bright green'.

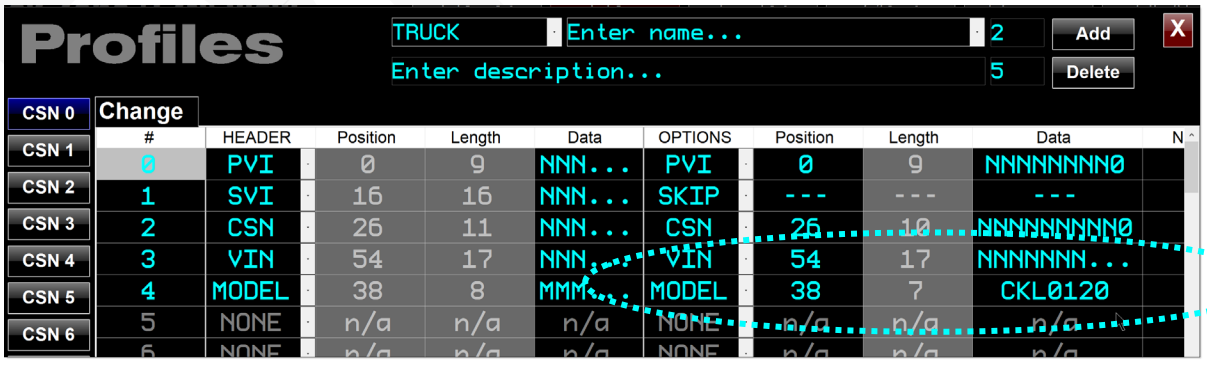


Common Cause: The EPP PLC is marking the Job data generated by the Control App as 'invalid' and will not drive error proofing based on the data.

SOLUTION 1: The MODEL CODE is failed the checks in the PLC and needs to be corrected.

In the example Footprints -162 and -163 are 'invalid' because the MODEL CODE is illegal.
And the Job in Footprint -165 is marked 'valid' because the MODEL CODE is legal.

Correct this by updating your **PROFILE** that generates the MODEL CODE.



Appendix A: The MicroCODE API Logix Program

In order to ensure that this App can do no harm in a General Motors production environment MicroCODE has separated the communication to an EPP Cell Controller into two (2) distinct connections as mentioned in Chapter 4.

NOTE: This App is never supposed to be run within a GM Production Facility, but MicroCODE has still gone to great lengths to code it in such a way as to protect GM Production from a user accidentally or unknowingly running it in a GM Plant.

READ-ONLY Connection – i.e.: 'Viewer Mode'

The first is a connection to the 'EPP Cell Controller', this connection, at the CIP Driver Level, is creation as a 'read only' interface that cannot write to Tags in the Logix 5000.

This connection is used for:

1) Displaying Tracking Data from the EPP PLC.
2) Displaying Conveyor Status from the EPP PLC.
2) Displaying the GEPICS Build Data buffer from the EPP PLC.
3) Displaying the GSIP Defect Queue from the EPP PLC.
4) Displaying the GEPICS Trace Data Queue from the EPP PLC.

READ-WRITE Connection – i.e.: 'Control Mode'

The second is a connection to the 'MicroCODE Application Programming Interface (API)' **only.** Which must be added to any EPP Cell Controller – before this is a READ/WRITE connection for giving the Cell Controller simulation commands will have control.

So, if a Plant has not imported the **MicroCODE prgAPI** program into their Cell Controllers, then the MicroCODE Control (EPP) App cannot write anything into the PLCs.

And, once **prgAPI** is installed (imported) into the EPP PLC, the App can only write to the Tags of that interface. Those tags are named **API_*** and are Controller Level Tags.

All the interaction between the Control App and the EPP PLC code is handled by the API Program. It receives command from the Windows App, executes them, and produces a status back to the App so it can verify execution.

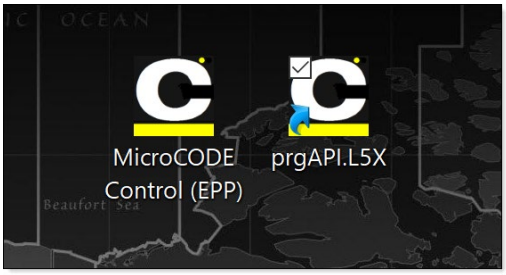
A Cell Controller can have this interface removed at any time, see **A.2 Uninstalling the MicroCODE API**.

A.1: Installing MicroCODE API Logix Program

The MicroCODE API is installed in the **EPP PLC only**.

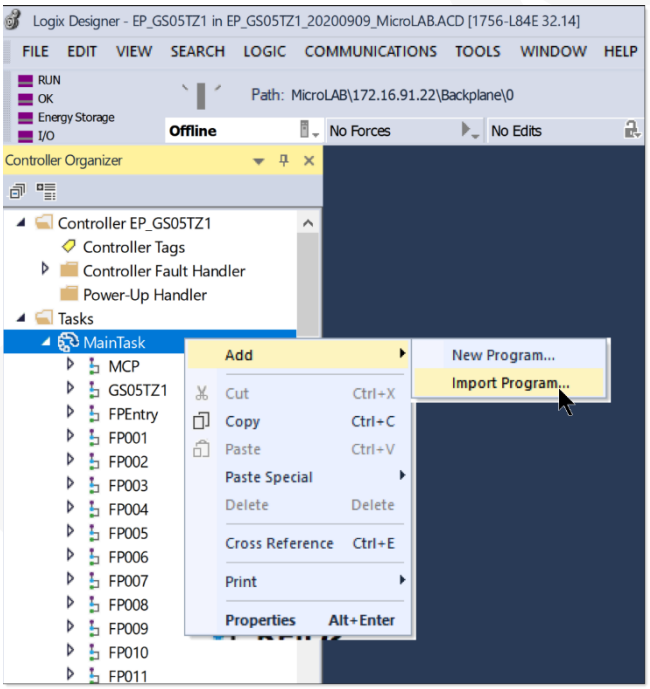
The API is provided as a standard Logix 5000. L5X Import/Export file, and a shortcut is left on the user's desktop after install:

NOTE: Always use the **prgAPI** that was provided with the App you installed. These program's version must match the version of the Windows App you are using.



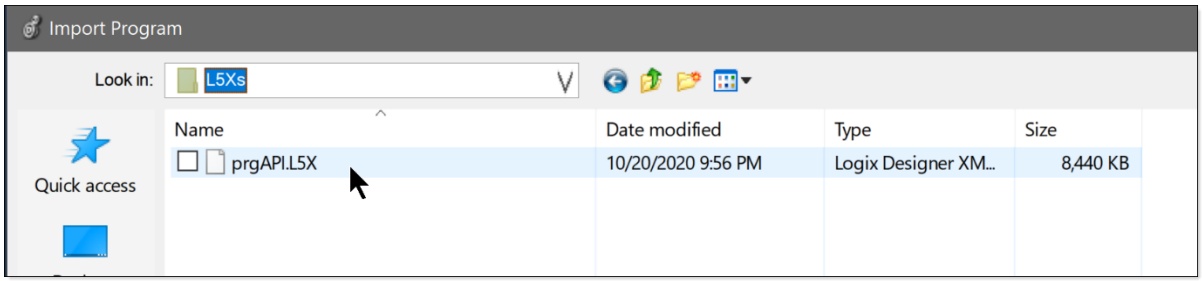
STEP 1: Import the Program named "prgAPI" into the Continuous Task (tskContinuous).

To import, Right-Click on **MainTask**, select **Add**, and the **Import Program…**.

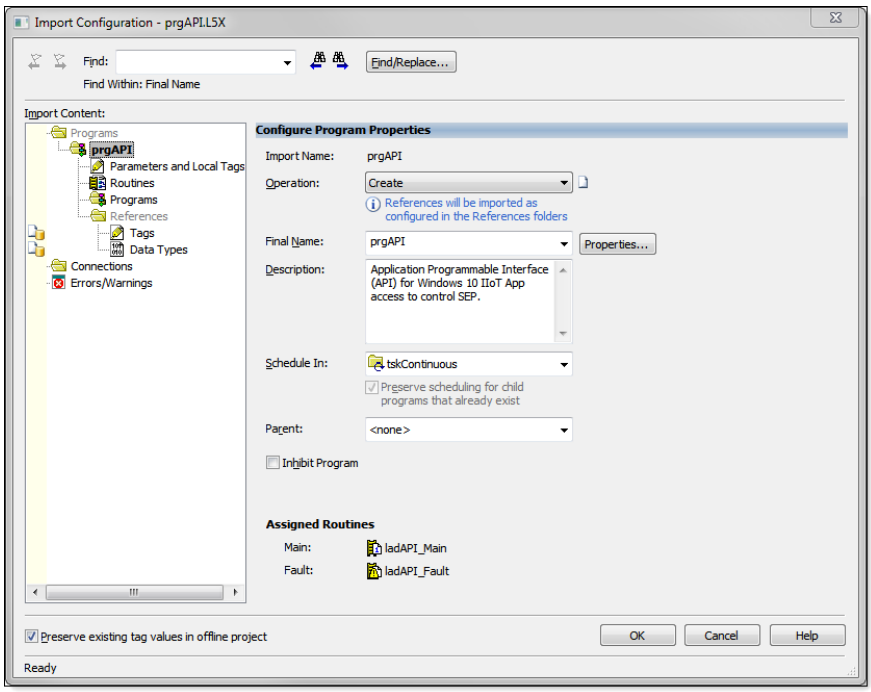


Select the API version that was distributed with you App release (they must match) and click **OK.**

```
C:\Program Files\MicroCODE Incorporated
\MicroCODE Control (EPP)\L5Xs
```



After preparation Logix 500 will present the **Import Configuration** dialog box:



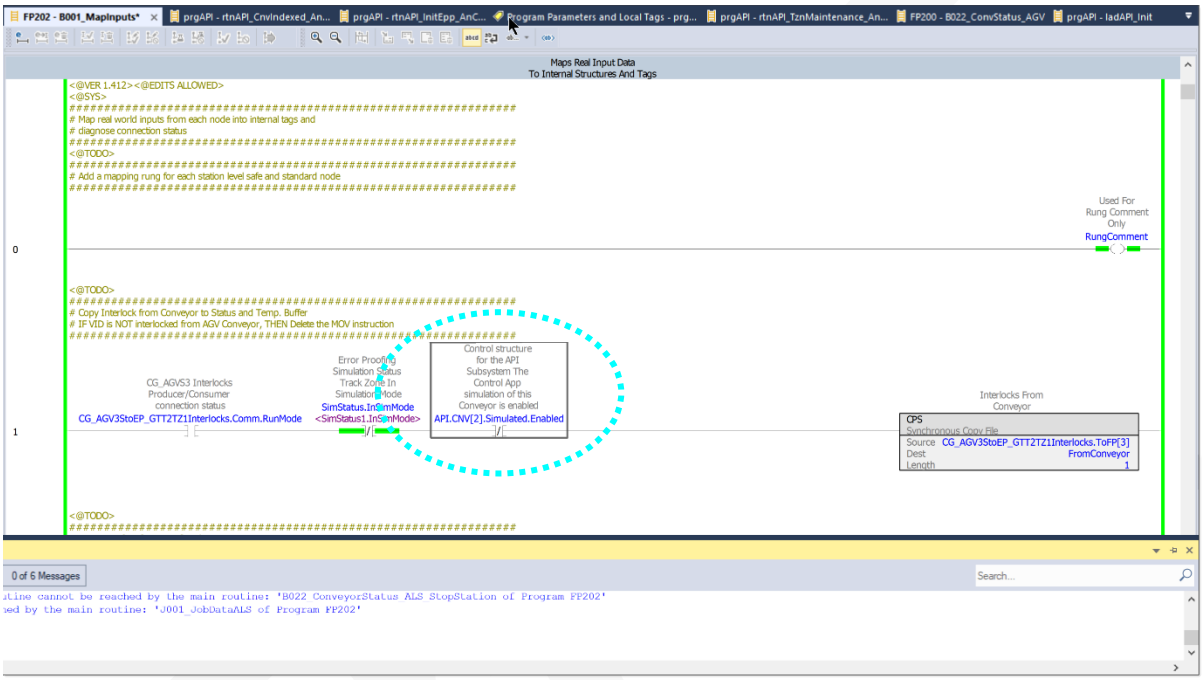
Just click **OK** and **Finalize all edits** in the next step, that's it.

Because the is a completely independent program it does that alter any existing EPP User Defined Datatypes or Code.

STEP 2: Add an API simulation to block consuming real Tags in Footprint Programs.

This step is required because the EPP PLC code directly uses the Conveyor Inputs from a Consumed Tag in the Footprint level code, rather than an intermediate generic object.

In every **FPnnn Program's B001_MapInputs** add NOT of **API.CNV[n*].Simulated.Enabled** to block being the Consumed tag into the temporary Tag "**fromConveyor**".



* **NOTE:** on the mapping of MicroCODE Control.NET App Conveyor indices (**.CNV[n]**) to EPP Conveyors for Stop Stations / Accumulating Lane Stops (ALS) or Automated Guided Vehicles (AGV):

EPP Conveyor Interface	EPP PLC Code	MicroCODE Control.NET App/API Conveyor Index
1st Track Zone – Entry	Conveyor interface for 'ID Zone'	CNV[0]
1st Track Zone – 1st Footprint	Conveyor interface for '1st Footprint'	CNV[1]
1st Track Zone – 2nd Footprint	Conveyor interface for '2nd Footprint'	CNV[2]
2nd Track Zone – Entry	Conveyor interface for 'ID Zone'	CNV[3]
2nd Track Zone – 1st Footprint	Conveyor interface for '1st Footprint'	CNV[4]
2nd Track Zone – 2nd Footprint	Conveyor interface for '2nd Footprint'	CNV[5]
2nd Track Zone – 3rd Footprint	Conveyor interface for '2nd Footprint'	CNV[6]
3rd Track Zone – Entry	Conveyor interface for 'ID Zone'	CNV[7]
3rd T rack Zone – 1st Footprint	Conveyor interface for '1st Footprint'	CNV[8]
3rd T rack Zone – 2nd Footprint	Conveyor interface for '2nd Footprint'	CNV[9]

RULE: Every **FPEntry** takes a Conveyor Interface, every SAI or AGV Footprint takes a Conveyor Interface.

STEP 3: Add an API simulation to override the RFID verification in Footprint Programs.

This step is required because the EPP PLC code uses RFID Tag reads to validate every Footprint's Carrier/Job. This verification is also overridden for the EPP Server simulation as well.

In every **FPnnn Program** add **API.CNV[n].Simulated.Enabled** to override the examination of the RFID Match.

If using Fixed Position Stop (**FPS**) chain Conveyor Interfaces these changes are made in the **FPnnn Program B021_ConveyorInterlock** or **B021_ConveyorStatus** depends on your EPP code version. This will be found in the TRACK ZONE Program for FPS Conveyors.

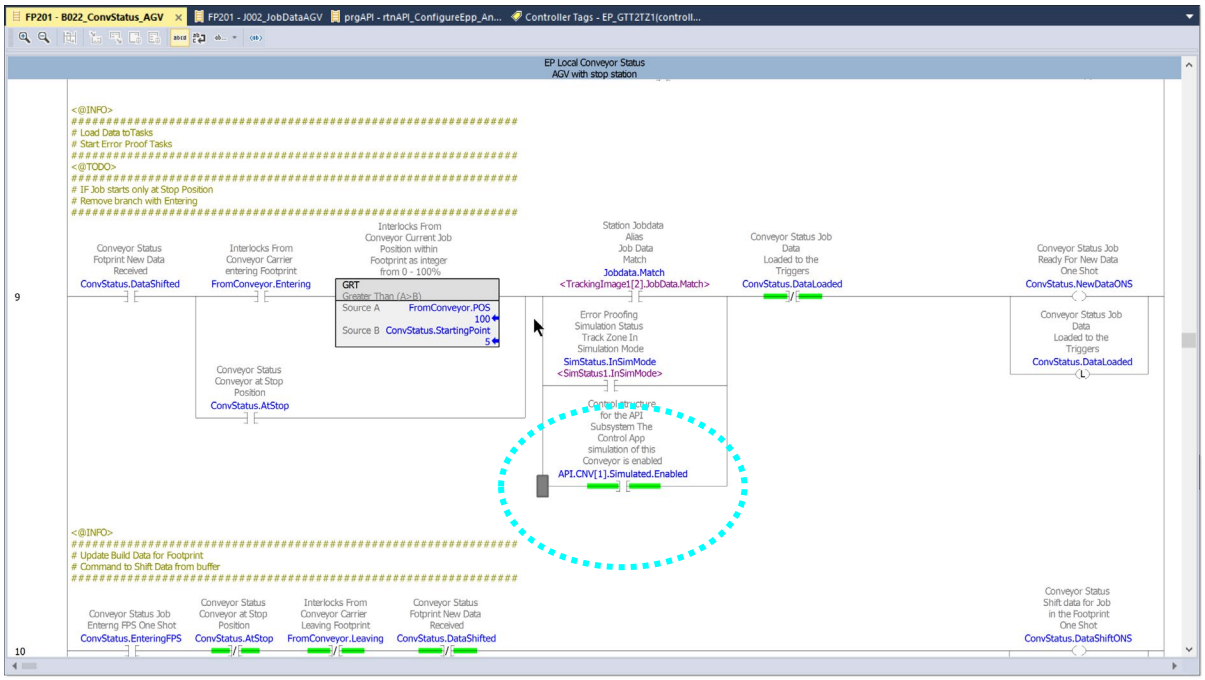
If using Accumulating Lane Stop (**ALS**) Conveyor Interfaces these changes are made in the **FPnnn Program B022_ConvStatus*ALS**. This will be found in the FOOTPRINT Program for ALS Conveyors.

If using Automated Guided Vehicles (**AGV**) Conveyor Interfaces these changes are made in the **FPnnn Program B022_ConvStatus*AGV**. This will be found in the FOOTPRINT Program for AGV Conveyors.

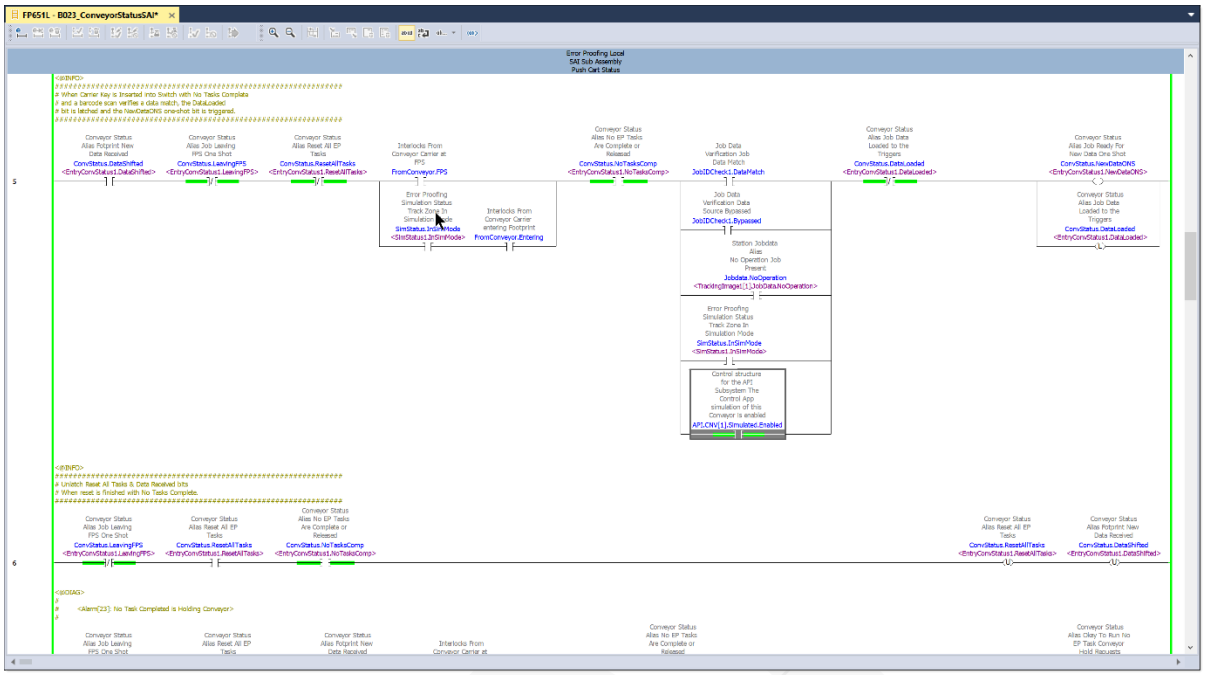
If using Sub-Assembly Integration (**SAI**) Conveyor Interfaces these changes are made in the **FPnnn Program B023_ConvStatus*SAI**. This will be found in the FOOTPRINT Program for SAI Conveyors.

NOTE: If your **ConvStatus.DataLoaded** rung does not have 'Jobdata.Match' then you do not need to add the API Simulated status.

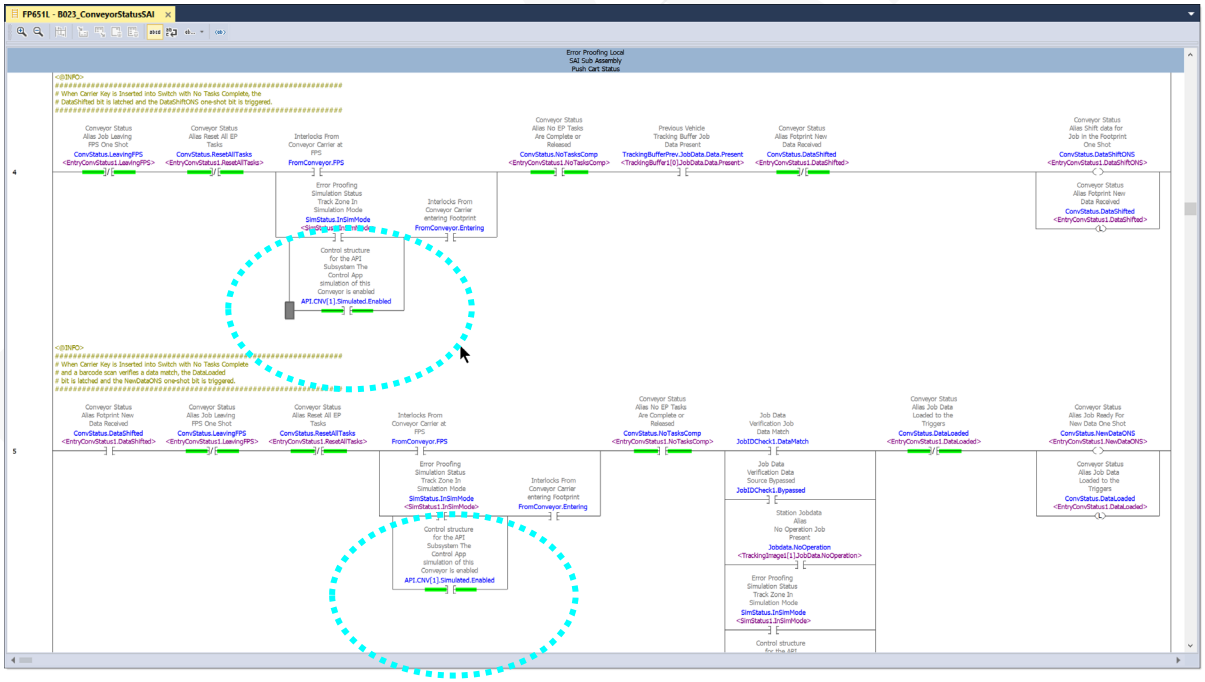
AGV Example:



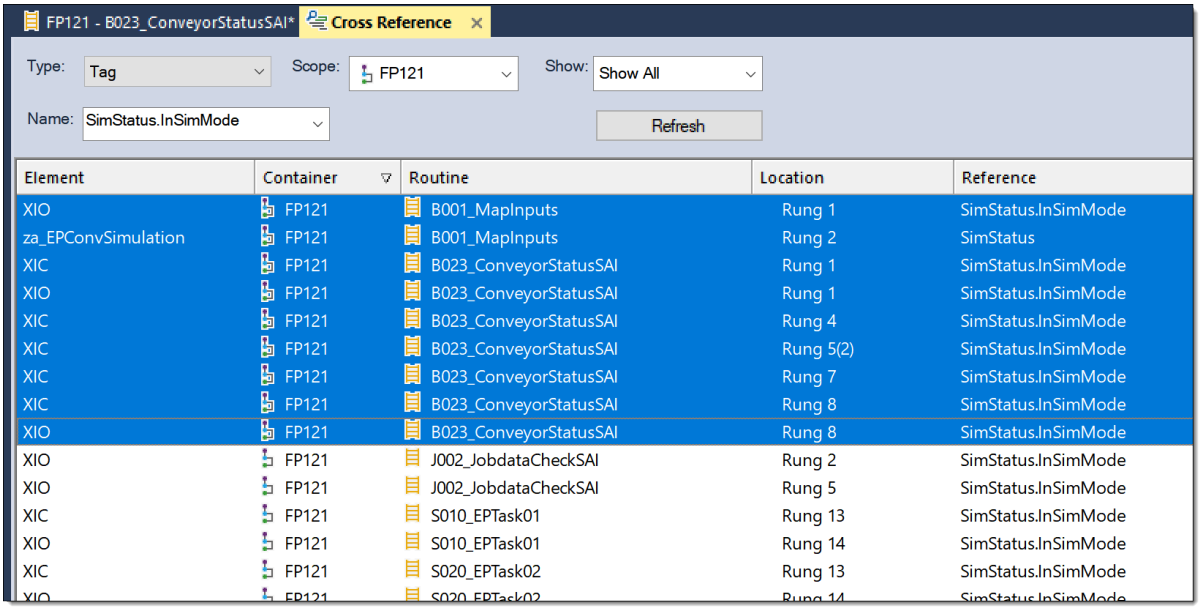
SAI Example:



For every Footprint add **API.CNV[n].Simulated.Enabled** to 'Entering' from the ID ZONE….



NOTE: To ensure consistent operation of the Control.NET App cross-reference the **SimStatus.InSimMode** alias in Logix 5000 and add the MicroCODE App signal in parallel if normally open, or in series if normally closed everywhere it is referenced in the **Conveyor** code, do not touch the Job Data or Task code. **Do this for every Footprint Program.**

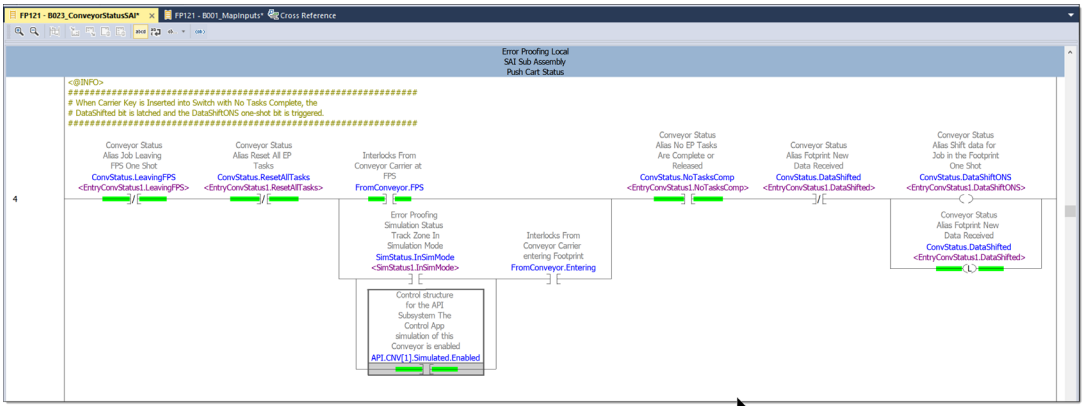


Element	Container	Routine	Location	Reference
XIO	FP121	B001_MapInputs	Rung 1	SimStatus.InSimMode
za_EPConvSimulation	FP121	B001_MapInputs	Rung 2	SimStatus
XIC	FP121	B023_ConveyorStatusSAI	Rung 1	SimStatus.InSimMode
XIO	FP121	B023_ConveyorStatusSAI	Rung 1	SimStatus.InSimMode
XIC	FP121	B023_ConveyorStatusSAI	Rung 4	SimStatus.InSimMode
XIC	FP121	B023_ConveyorStatusSAI	Rung 5(2)	SimStatus.InSimMode
XIC	FP121	B023_ConveyorStatusSAI	Rung 7	SimStatus.InSimMode
XIC	FP121	B023_ConveyorStatusSAI	Rung 8	SimStatus.InSimMode
XIO	FP121	B023_ConveyorStatusSAI	Rung 8	SimStatus.InSimMode
XIO	FP121	J002_JobdataCheckSAI	Rung 2	SimStatus.InSimMode
XIO	FP121	J002_JobdataCheckSAI	Rung 5	SimStatus.InSimMode
XIC	FP121	S010_EPTask01	Rung 13	SimStatus.InSimMode
XIO	FP121	S010_EPTask01	Rung 14	SimStatus.InSimMode
XIC	FP121	S020_EPTask02	Rung 13	SimStatus.InSimMode
XIO	FP121	S020_EPTask02	Rung 14	SimStatus.InSimMode

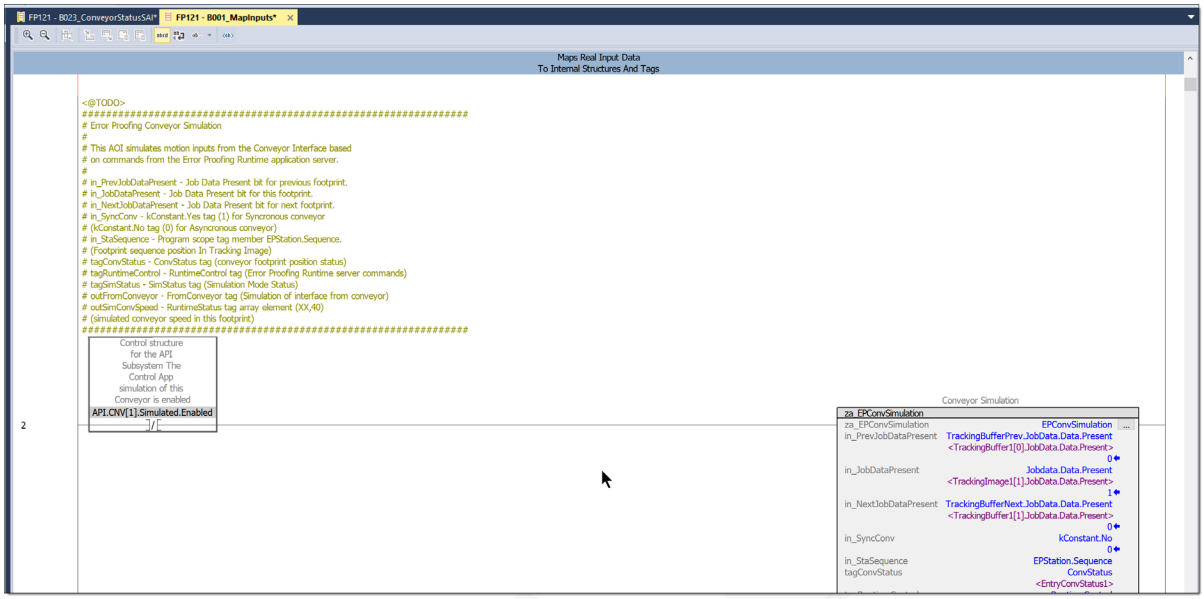
Everywhere the GM IT Server's SIM Mode requires overriding normal PLC code operation the MicroCODE Control.NET App requires the exact same thing.

In **SERIES** (normally closed reference) example:

In **PARALLEL** (normally open reference) example:

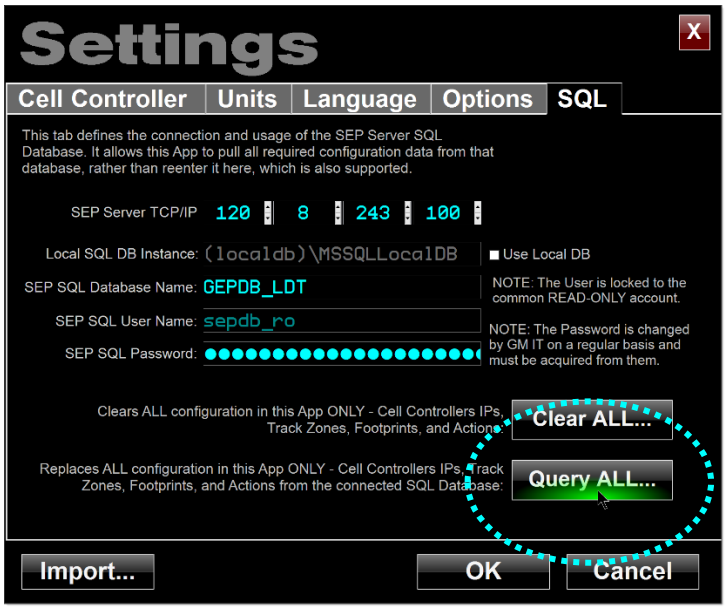


Also, be sure to block the GM IT Conveyor Simulation while the MicroCODE Control.NET App is simulating movement in the same area…

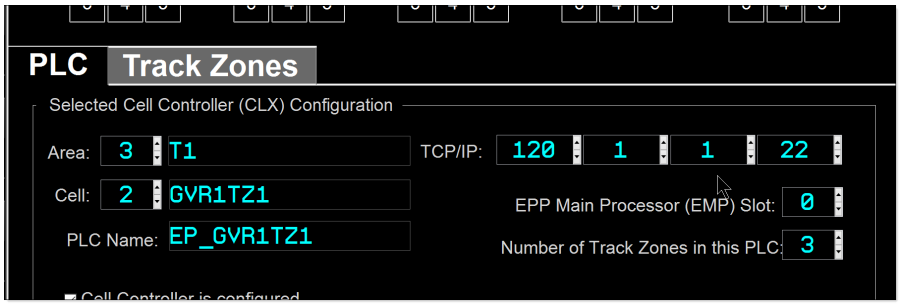


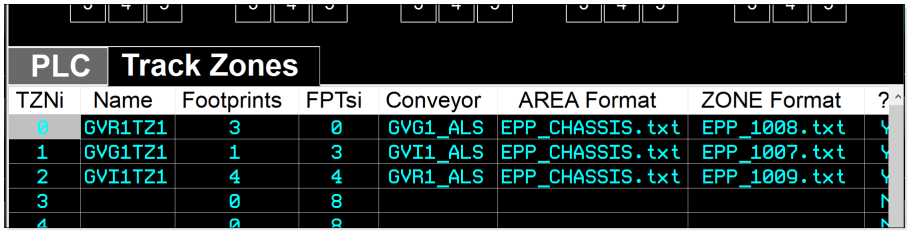
STEP 4: Query your current EPP SQL Database from the SETTINGS Dialog Box

This step is required to being the complete EPP configuration into the Control App. This is then used to auto-configure the API in the EPP PLC the next time you go online.



Be sure after a re-query that you EPP PLC Ips match your environment, the EPP SQL Database value for the IP Addresses will always overwrite what you have. Double-check that you have configured GEPICS Formats as well.



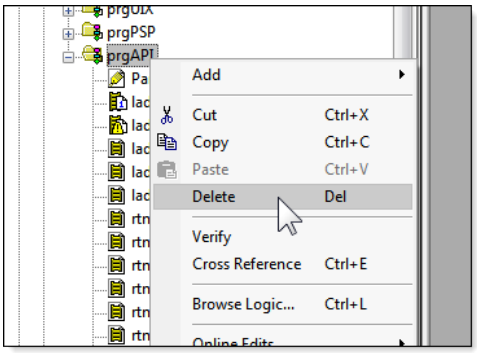


That's, it, go online and start your simulation work.

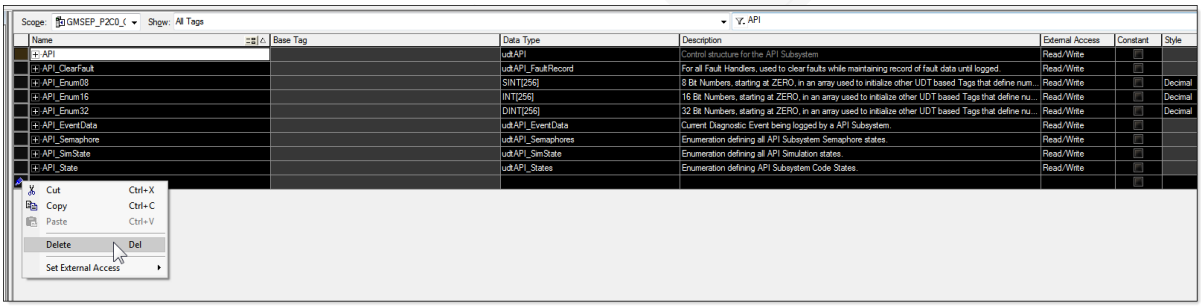
A.2: Uninstalling MicroCODE API Logix Program

Following these steps to uninstall the MicroCODE API from a EPP PLC:

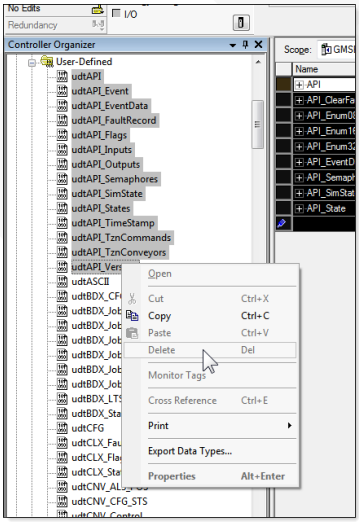
STEP 1: Delete the entire Program named "prgAPI".



STEP 2: Delete all Controller Level Tags named "API*".



STEP 3: Delete all User Defined Datatypes named "udtAPI*".



NOTE: Step 1 and **Step 2** can be done ONLINE. But **Step 3** must be done OFFLINE and then the Logix 5000 program has to be downloaded back into the PLC.

And you must make several passes at deleting all the UDTs because you cannot delete a UDT if it is referenced by another.

Leaving these UDTs in the Controller has no affect on normal EPP operations.

STEP 4: Delete the modifications made to the Conveyor Interfaces.

This will not compile after you deleted the Controller Level API Tags and the errors will guide you to the code you must remove.

Appendix B: Required EPP Patches for Control App

One of the stated requirements for the new Control EPP App was that it work with the EPP PLC code that is already in the field, without alteration.

The EPP PLC Code version supported are:

- **EPP v1.0.0** – 2018-2020 (Lake Orion)
- **EPP v?.?.?** – 2020-2022 (Plant Zero)

At the time of development, the EPP code for Plant Zero had not been finalized. Changes are expected.

These files are all installed in folders in:

```
GM Supplier Power
```

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Appendix C: Memory and I/O Management in the App

One of the implied requirements for the new Control EPP App was that it minimize the communication load placed on the EPP PLCs and Ethernet Cards.

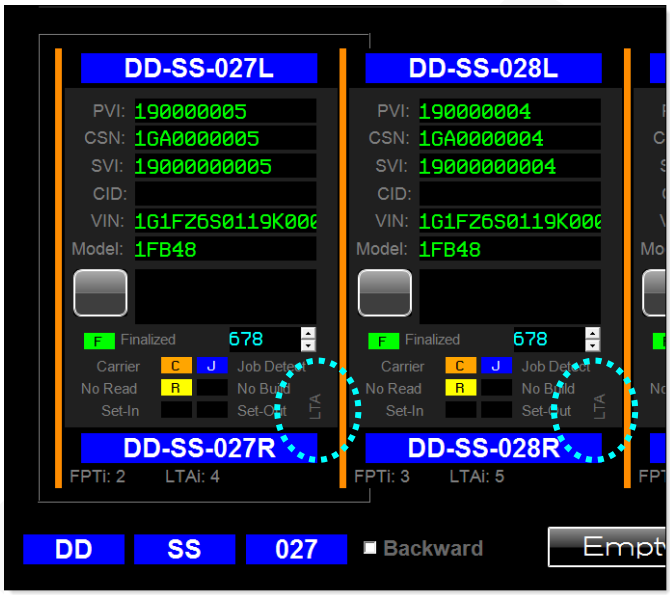
To support this—starting with Release **v1.0.0**—the App added an internal memory of the last (128) GEPICS Jobs it was read from a Controller. This is used to dramatically reduce the amount of data that must be read from the PLCs while the App is running.

This internal memory is cleared under the following conditions:

- On App exit, i.e.: it is not stored to disk.
- When the SITE SET-UP is changed, to prevent using data for a PVI from another Cell, which may have a different GEPICS Format.
- When a new SIMULATION is started to discard all memorized Jobs from a previous PROFILE SET-UP.
- Whenever the User issues the Simulation Command: EMPTY TRACK ZONE.

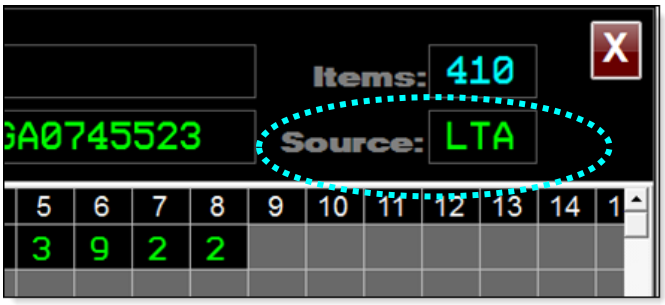
The App always shows where the Job data has come from with new indicators on all displays.

In the TZN Tracking display:



In the BDX Buffer display:

In the GEPICS Data Viewer:



Memory Indicators and meaning:

APP = generated by the App during initialization.

PLC = directing read from PLC memory.

LTA = recalled from App's internal memory, originally read from the EPP Line Tracking Array (LTA).

BDX = recalled from App's internal memory, originally read from the EPP Build Data Interface (BDX).

BDZ = recalled from App's internal memory, originally read from the EPP Build Data Interface (BDX), but with tracking status (Job, Carrier, No Build, etc.) updated from the EPP Track Zone in the PLC.

SIM = generated by the App during simulation, normally this is never seen on the User display.

UNK = unknown.

Appendix D: Allen-Bradley L8x Processor Support

Starting with v2.0.0 this App includes a new ControlNet Interface Protocol (CIP) Driver capable of communicating with the new line of L8x PLCs. The cost of this new driver is built into the App upgrade or purchase price and provides a site-wide license allows as many clients (running this App) as required.

These processors feature 5x – 20x scan time improvements and a built in 1GB Ethernet Port.

NOTE: This is a ‘Site’ license, not a ‘Company’ license. It is tied to a specific manufacturing site and is not allowed to be used elsewhere. If multiple Sites are to be supported each must have a ‘Site’ license copied of the App. The ‘Site’ location is visible in the **About…** box of the App itself.

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Document: MCX-U01 (Control - EPP - User Guide).doc

I rate this manual's:	Excellent			Good				Fair		Poor
Accuracy (software works as manual says)	10	9	8	7	6	5	4	3	2	1
Completeness (enough information)	10	9	8	7	6	5	4	3	2	1
Clarity (easy to understand)	10	9	8	7	6	5	4	3	2	1
Organization (structure of subject matter)	10	9	8	7	6	5	4	3	2	1
Figures (useful)	10	9	8	7	6	5	4	3	2	1
Examples (useful)	10	9	8	7	6	5	4	3	2	1
Index (ability to find topic)	10	9	8	7	6	5	4	3	2	1
Page layout (easy to find information)	10	9	8	7	6	5	4	3	2	1

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The **MicroCODE Control (EPP)** App was created for General Motors Strategic Suppliers by: