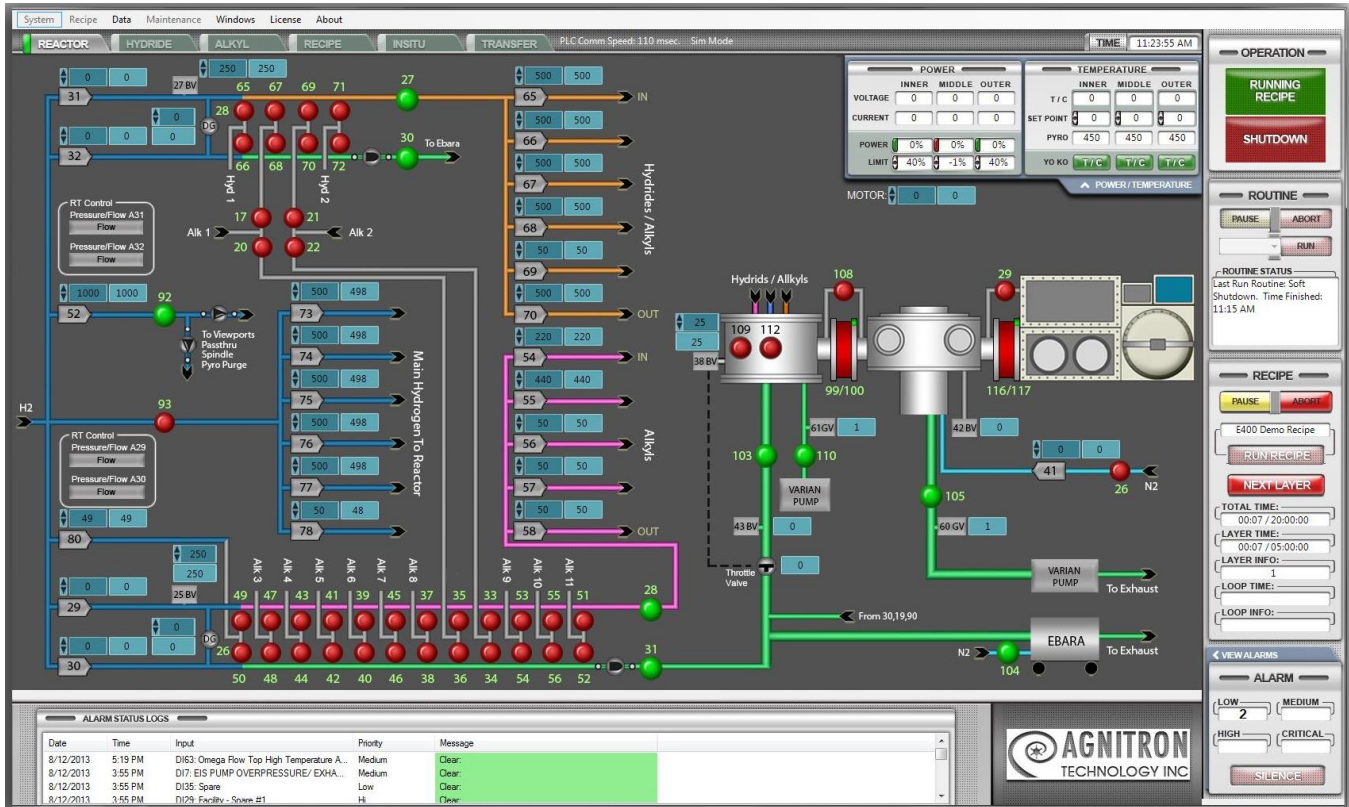# IMPERIUM-*MOCVD*TM Control Software Data Sheet

Overview

- Configurable for any make or model MOCVD system

- Exceptional flexibility for users to configure graphical layout and I/Os

- Built-in customization features for unique configurations ex. plasma sources, RF heating

- Offered as a stand alone upgrade for all legacy MOCVD systems

- Supports analog/digital PLC IO interfaces as well as DeviceNet CAN platforms

- Configurable for any PLC – commonly used with Allen Bradley, CTC, and OMRON

- Product of collaboration by MOCVD scientists, engineers, technicians and maintainers

Features

- **Platform Requirements**

  - Microsoft Windows 7 Operating System
  - Intel® Core™ i7-860 Processor
  - (8M Cache, 2.80 GHz)
  - Dual 23" flat panel monitors
  - Ethernet serial communication protocol for analog/digital I/O PLC interfaces as well as DeviceNet CAN platforms

- **Software Architecture and Features**

  - Graphical display of system status for all growth processes including gas flows, MO source pressure, MO bath temperature, reactor chamber status (susceptor temperature, reactor pressure, water-cooling temperature etc.), exhaust system status, load lock functions
  - Database used for managing recipe parameters and for logging process data
  - Tabbed interface screens makes switching views fast and easy
  - Multi-screen mode enables use of dual monitors for more efficient system monitoring
  - All system routines are configurable by Administrator users; standard factory prepared routines include H2/N2 idle, system shutdown, system soft shutdown, bubbler change, reactor loading, loadlock loading etc.
  - IMPERIUM is fully customizable by customer which enables software expansion to match future hardware modifications (new MO line etc.) with or without Agnitron support

- **Safety**

  - Handshake communication protocol triggers MOCVD system safe state if communication is interrupted between control computer and PLC
  - Safety interlocks configured to automatically shutdown system in event of an emergency or unsafe operating conditions – can also be configured to communicate and trigger facility alarms
  - Fully functional non-operational simulation mode enables running IMPERIUM without connecting to hardware for training and testing
  - Fully configurable system alarm conditions
  - Fully configurable system responses to digital alarms or user selected analog threshold limits
  - Network compatible to allow remote viewing of system status, event log, alarm log

- **Production Capabilities**

    - 4 user levels enable each customer to restrict privileges by user group: Administrator, Engineer, Maintenance, and Operator
    - Data sharing and export capabilities enable communications with enterprise scale data management tools

- **Data Logging**

    - All analog and digital input and output signals are saved to process data log during execution of recipes
    - Screenshot of Insitu Process Monitoring screen automatically saved to process data log folder at end of recipe execution
    - Copy of recipe file is saved to process data log as it was executed – this record captures changes that may have been made to the recipe by the operator during execution

- **Data Plotting**

    - Real time plotting capabilities for up to 5 analog channels at a time
    - Saved data plotting enables visualization of data from previously executed growth runs

- **Insitu Process Monitoring**

    - Real-time graphical display of reactor conditions – multizone heater temperature set points and actual values measured by T/C or pyrometer
    - Display of k-Space, RealTemp or LayTec reflectance, temperature and curvature data or other user metrology system

- **Insitu Metrology Feedback Control**

    - Data generated by insitu metrology tools such as temperature, reflectance or curvature can be used as feedback to control process

- **Routines**

    - Standard routines such as idle, wafer loading and shutdown states are pre-configured
    - Customer administrator users are able to modify existing routines and configure new routines

- **Recipes**

    - Recipes are organized in a spreadsheet format for clear display of all recipe parameters by recipe layer
    - Real-time in-process recipe modification
    - Looping and loop within loop capability for growth of repeating structure layers
    - Recipe packing feature simplifies recipe viewing and draws attention to critical parameters

- Offline recipe editor is included to enable recipe editing on office computer away from system
- Deviation alarms notify user if recipe parameter values are operating outside preselected range

- **Maintenance**

  - Alarm log records time, date and level of all system alarms
  - Event log records time and date for all system events such as execution of routines, recipe execution and alarms
  - Graphical interface that enables on screen editing and tuning of temperature controller PID constants as well as uploading/downloading these values to and from controllers

- **Robot Control**

  - Genmark robot control integrated into IMPERIUM graphical interface for streamlined control and operation (if robot is used)
  - User has full control to select sequence of robot moves for transporting wafer carrier between stations – hard coded safety rules prevent user from unsafe commands
  - Robot line commands can be manually entered or preselected station to station routines are available