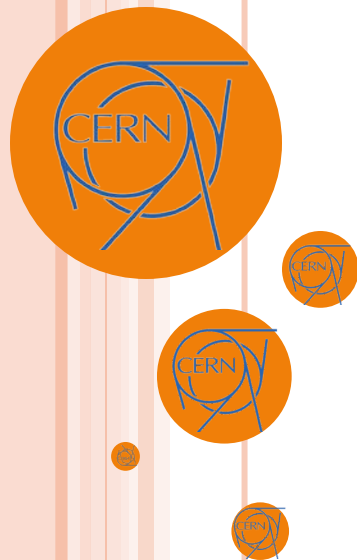


# UNICOS: UNIFIED INDUSTRIAL CONTROL SYSTEM CPC (CONTINUOUS PROCESS CONTROL)

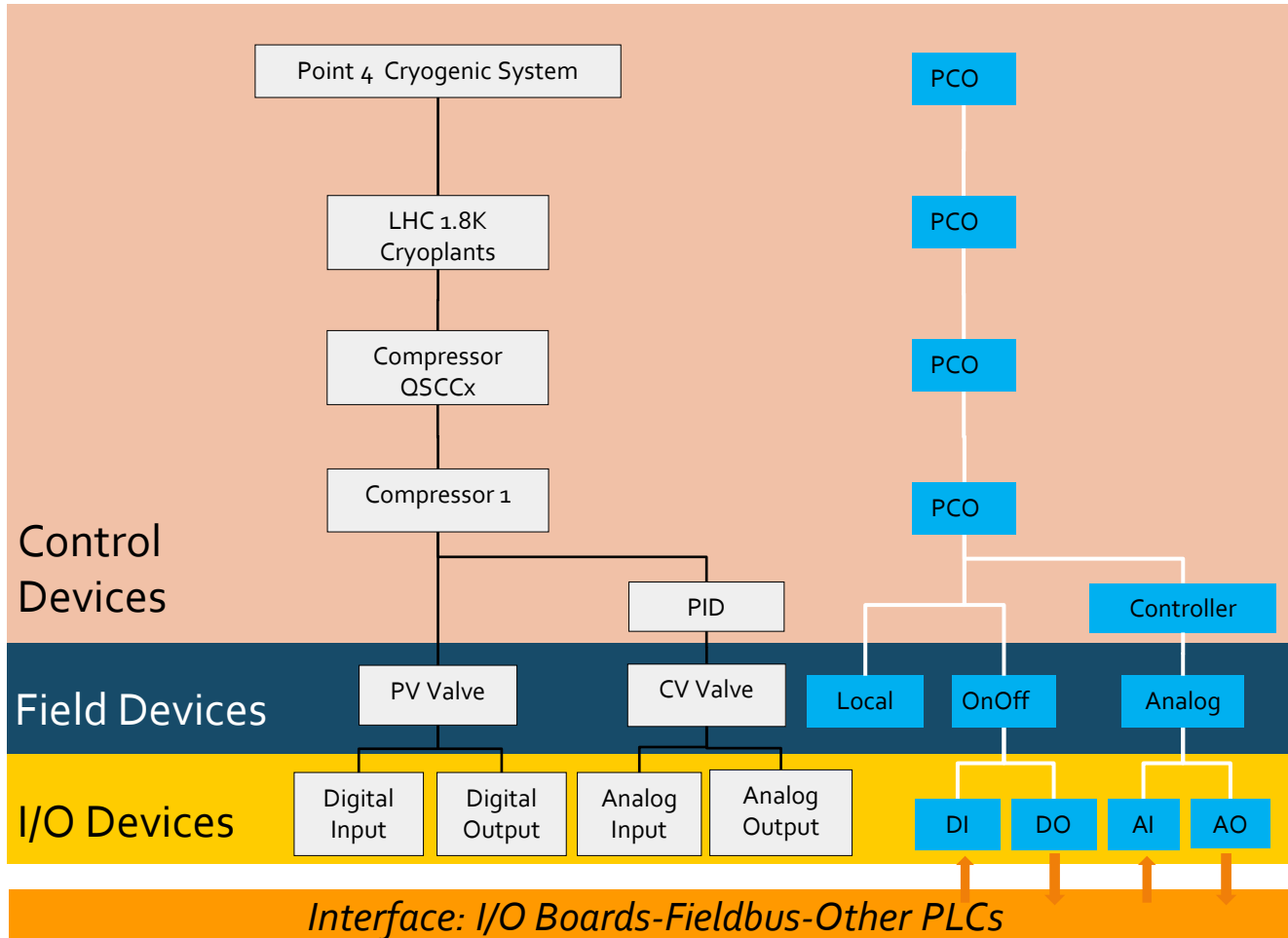
**BASIC COURSE**

**SESSION 3: PLC ARCHITECTURE**

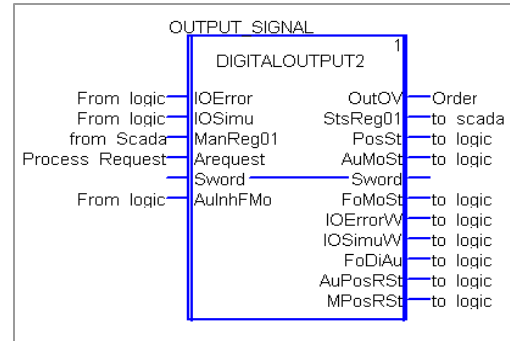
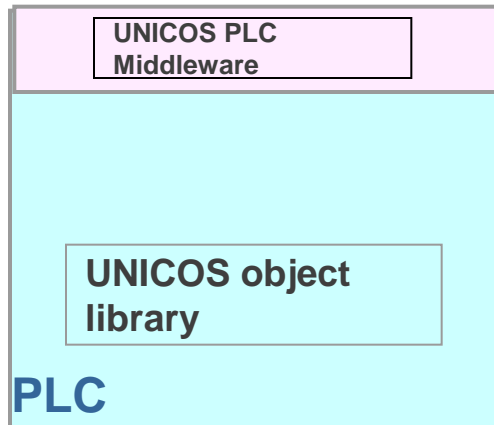
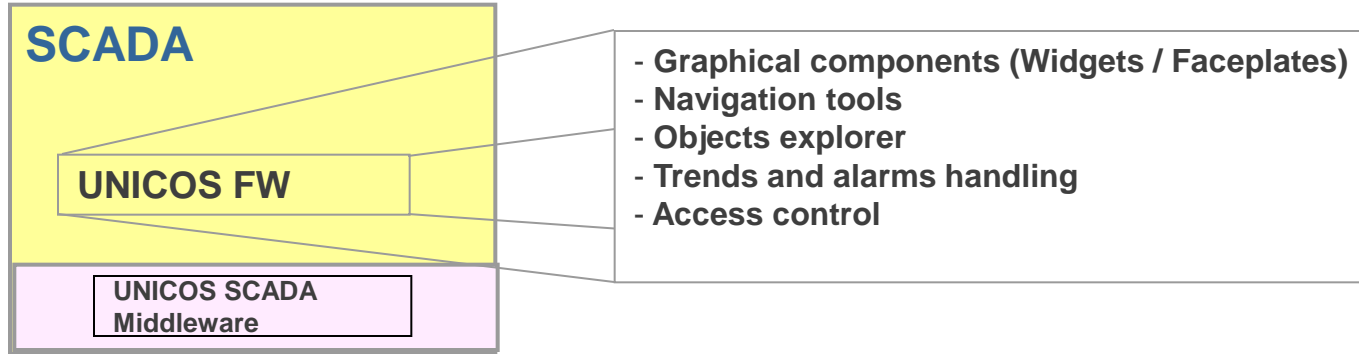


**UCPC 6**  
UNICOS-Continuous Process Control

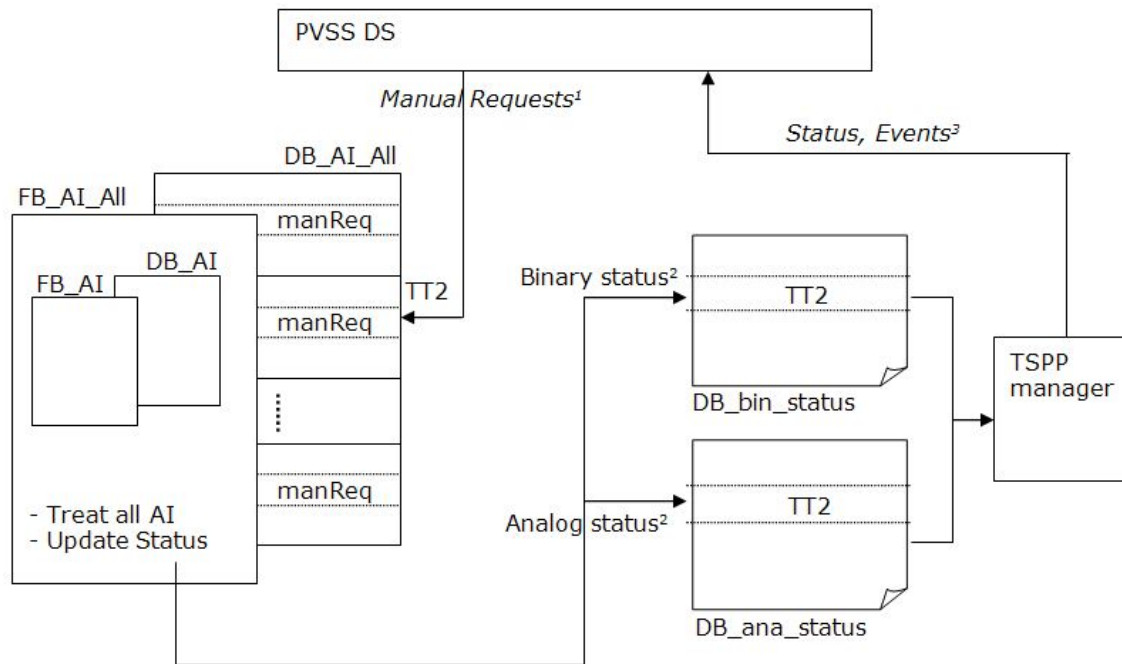
- IO objects:
  - Analog Input (AI). Function block CPC\_FB\_AI.
  - Analog Input Real (AIR). Function block CPC\_FB\_AIR.
  - Analog Output (AO). Function block CPC\_FB\_AO.
  - Analog Output Real (AOR). Function block CPC\_FB\_AOR.
  - Digital Input (DI). Function block CPC\_FB\_DI.
  - Digital Output (DO). Function block CPC\_FB\_DO.
- Field Objects:
  - Local. Function block CPC\_FB\_LOCAL.
  - OnOff. Function block CPC\_FB\_ONOFF.
  - Analog. Function block CPC\_FB\_ANALOG.
  - AnaDO. Function block CPC\_FB\_ANADO.
  - Analog Digital (ANADIG). Function block CPC\_FB\_ANADIG.
- Control Objects
  - Process Control Object (PCO). Function block CPC\_FB\_PCO.
  - Analog Alarm (AA). Function block CPC\_FB\_AA.
  - Digital Alarm (DA). Function block CPC\_FB\_DA.
  - Controller (PID). Function block CPC\_FB\_PID.
- Interface Objects
  - Digital parameter (DPAR). Function block CPC\_FB\_DPAR.
  - Word parameter (WPAR). Function block CPC\_FB\_WPAR.
  - Analog Parameter (APAR). Function block CPC\_FB\_APAR.
  - Word Status (WS). Function block CPC\_FB\_WS.
  - Analog status (AS). Function block CPC\_FB\_AS.



# UNICOS SOFTWARE ARCHITECTURE



- TSPP. Time stamp push protocol.
  - Status of the objects
  - Events
  - Watchdog



- Baseline, provided by the UAB project.
  - Source file CPC\_BASE\_UNICOS
    - Data structures
    - Periphery access functions
    - Recipes function
    - Standard functions
    - Miscellaneous
      - Versioning
      - Edge detection
      - Run Time meter
  - Source files of CPC Objects functions
  - OBs, FBs, VAT and SFBs in the baseline “blocks” folder

- Instance files, generated by UAB.
  - 1\_Compilation\_baseline.INP
  - 2\_Compilation\_instance.INP.
  - 4\_Compilation\_OB. Creation of OBs and Diagnostic functions.
  - Instances of all the objects. (AI.SCL, AO.SCL...)
  - Communication.SCL. TSPP parametrization and event handling.
  - CPC\_TSPP\_UNICOS.SCL. TSPP function.
  - Symbols.sdf. Variable definition.
  - Recipes.SCL. Recipe interface definition.

- Logic files, generated by UAB.
  - 3\_Compilation\_logic.INP
  - DB\_ERROR\_SIMU.scl. Creation of user IO error and IO simu for the PCO.
  - FC\_controller.scl. Call to PID function.
  - FC\_PCO\_logic.scl. Call to all PCO sections and dependent logic functions for all the objects.
  - PCO sections
  - Field objects and PCO dependent logic.



## Default sections

- PCO\_BL.scl (Basic Logic)
  - IO Error IO Simu propagation among objects
- PCO\_CDOL.scl (Common Dependant Object Logic)
  - Auto Mode propagation
- PCO\_INST.scl (Instantiation)
  - PCO status and manual operation instantiation.

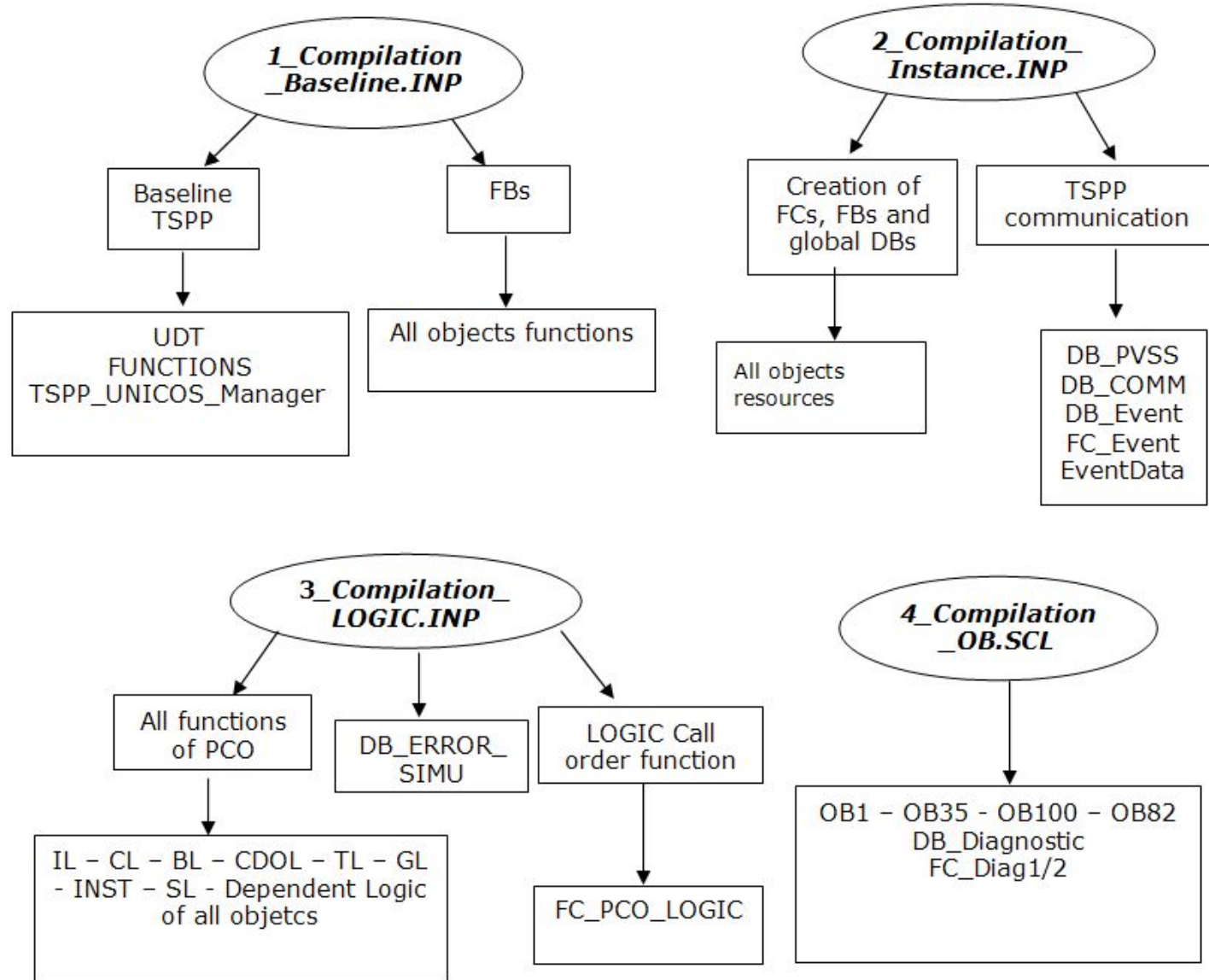
## USER sections

- PCO\_CL.scl (Control Logic)
  - Feedback On, Feedback Off, Controlled Stop, Auto Option Mode.
- PCO\_DL.scl (Dependent Logic)
  - PCO logic associated to Parent PCO. Typically based on parent PCO operational states.
- PCO\_GL.scl (Global Logic)
  - All generic logic associated to the PCO.
- PCO\_IL.scl (Interlock logic)
  - PCO alarms definition
- PCO\_SL.scl (Sequencer logic)
  - Call to graphcet function
- PCO\_TL.scl (Transition logic)
  - Stepper states transitions conditions.

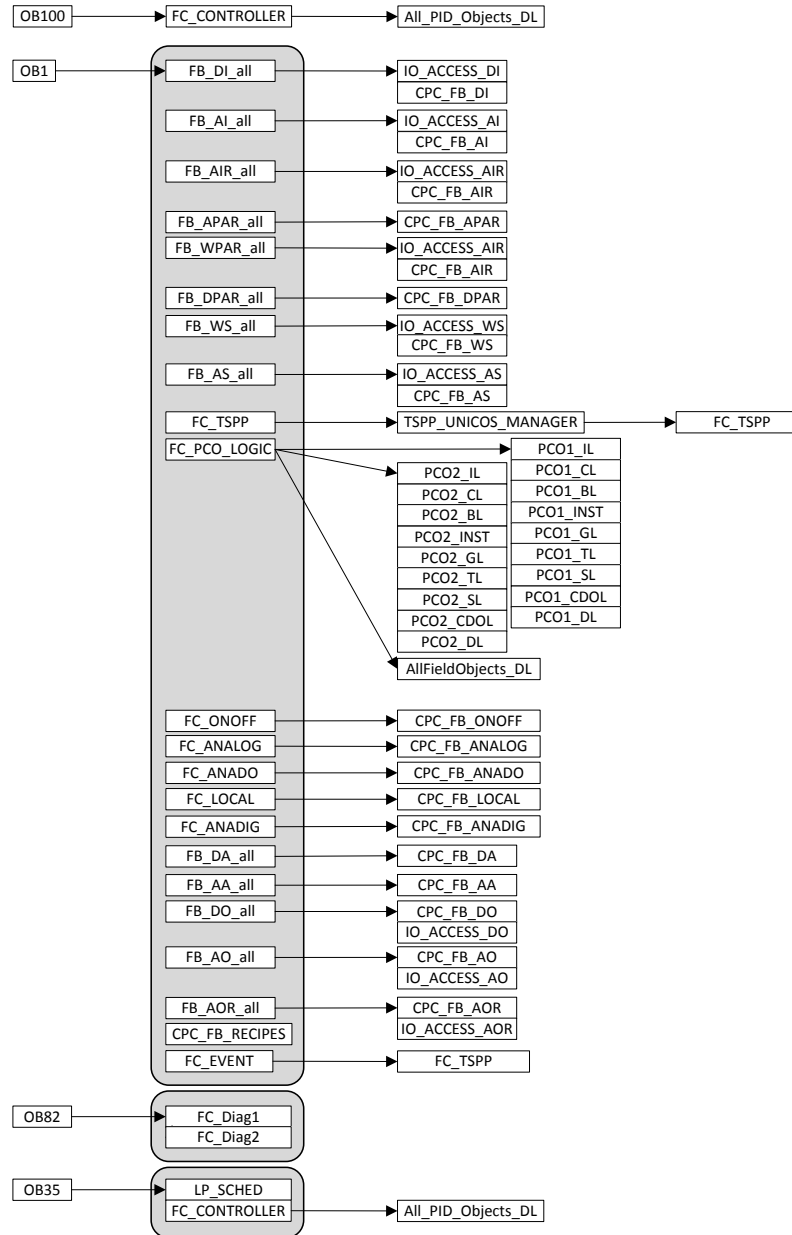
# ORGANIZATION BLOCKS (OB)

- OB1. Main OB.
  - Call to all the objects functions
  - Call to recipes function
  - UNICOS counter
- OB35. Cyclic interruption.
  - Call to PID function and scheduler.
- OB100. Warm restart.
  - Initialisation of some variables
- OB82. Diagnostic Interruption.
  - Call to diagnostic functions.
- OB80. Time error.
- OB85. Priority class error.
- OB121. Programming error.
- OB122. I/O access error.

# LOGIC GENERATION



# RUN-TIME APPLICATION



# OBJECT OPTIMISATION

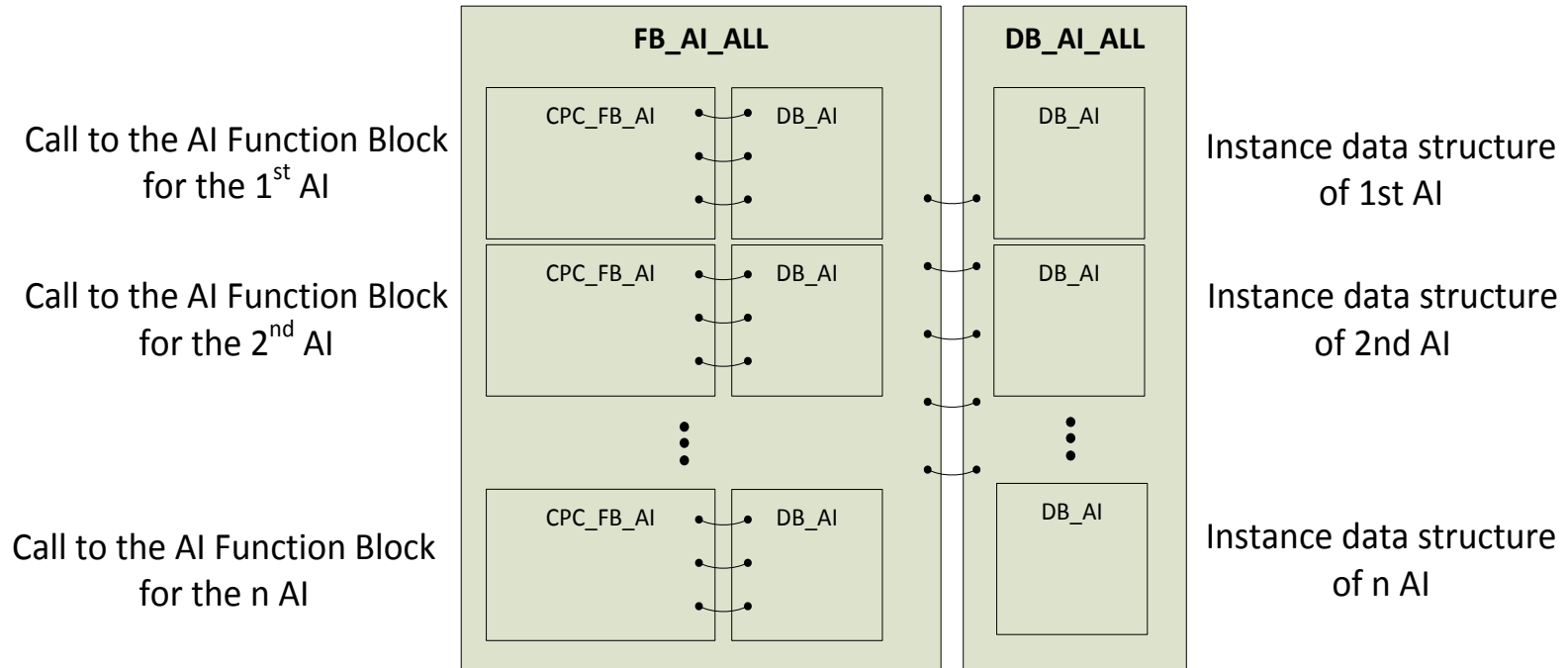
PROBLEM: Too many DBs.

SOLUTION: Encapsulate instance objects in DBs.

MECHANISM: Multi-instantiation

Optimised objects: AI, AIR, AO, AOR, DI, DO, AS, AA, DA, APAR, WPAR, AS, WS

- FB\_objectType\_all (multi-instance).  
All the objects are called inside.  
Instance DB encapsulated in DB\_objectType\_all
- DB\_objectType\_ALL





# ACCESS TO UNICOS OBJECT SIGNALS



Objects	Generic expression	Example
OnOff Analog AnalogDigital AnaDO Controller PCO	$\textit{ObjectName.VariableName}$	Example to read the position of an analog damper called "UACV1_UMRM_M02_222":  $\textit{UACV1\_UMRM\_M02\_222.PosSt}$
AI/DI/AO/DO AIR/AOR APAR/WPAR DPAR AS/WS DA/AA	$\textit{DB\_Type\_ALL.Type\_SET.ObjectName.VariableName}$  Type= DI, AI, DO, AO...	Example to read the value of an AI called "UACV1_UBT1_M08_222":  $\textit{DB\_AI\_ALL.AI\_SET.UACV1\_UBT1\_M08\_222.PosSt}$

Objects	Signal	Variable identifier	Type
All objects	I/O Error on the channel I/O simulated by operator	IOError IOSimu	Dig
ANALOG ANADIG ANADO CONTROLLER	Auto Position Request	AuPosR	Ana
AIR/AOR	Hardware Feedback Position	HFPos	Ana
ONOFF PCO	Auto On Request Auto Off Request	AuOnR AuOffR	Ana
ANALOG ANADIG ONOFF ANADO PCO	Start Interlock Temporary Stop Interlock Full Stop Interlock Alarm	StartI StopI FuStopI AL	Dig
Digital Alarm	Input signal	I	Dig
Analog Alarm	Input signal for comparison Auto Alarm Thresholds Auto Enable LL/L/H/HH thresholds	I LL/L/H/HH AuELL/L/H/HH	Ana Ana Dig
CONTROLLER	Auto Set Point Request	AuSPR	Ana
CONTROLLER	Auto Regulation Request	AuRegR	Ana
CONTROLLER	Auto Output Positioning Request	AuOutPosR	Ana
PCO	Feedback On/Off	Fon FOff	Ana
PCO	Auto Option mode request	AuOpMoR	Ana
PCO	Auto Control Stop Request	AuCOFFR	Ana

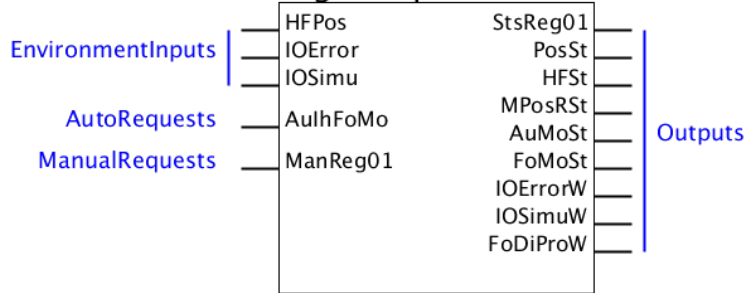


# UNICOS OBJECT OUTPUT SIGNALS

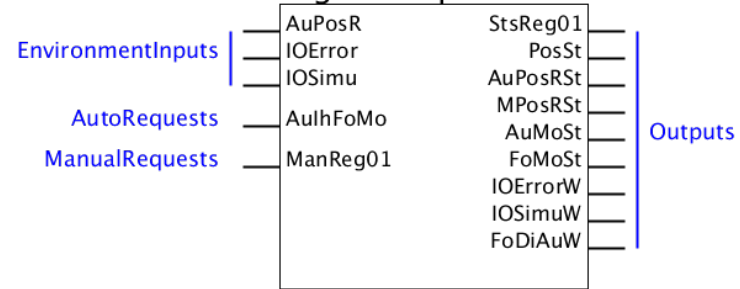
Objects	Signal	Variable identifier	Type
All objects	Position status	PosSt	Ana
All objects	IO Error Warning IO Simu Warning	IOErrorW IOSimuW	Dig
ONOFF	On/Off Position Status	OnSt OffSt	Dig
ANALOG ANADIG ONOFF ANADO PCO	Start Interlock Status Full Stop Interlock Status Temporary Stop Interlock Status Alarm	StartISt FuStopISt TStopISt ALSt	Dig
Controller	Output Order Value Active Set-point Regulation Mode Status Output Positioning Status	OutOV ActSP RegSt OutPSt	Ana Ana Dig Dig
Digital Alarm Analog Alarm	Interlock Status	Ist	Dig
Analog Alarm	Warning Status (H or L) HH/LL Alarm activated H/L Warning Activated Active threshold value	WSt HHASt / LLASt HWSt / LWSt HHSt/HSt/LSt/LLSt	Dig Dig Dig Ana
PCO	Run Order Status	RunOSt	Ana
PCO	Control Stop Order Status	CStopOSt	Ana
PCO	Active Option mode number	OpMoSt	Ana
PCO	Auto mode request sent to all dependent objects	AuDepOSt	Dig
PCO	On Status	OnSt	Dig
PCO	Off Status	OffSt	Dig

# UNICOS CPC OBJECTS. I/O

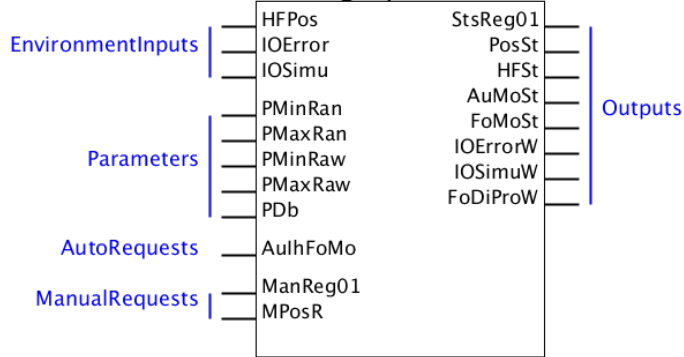
## DigitalInput



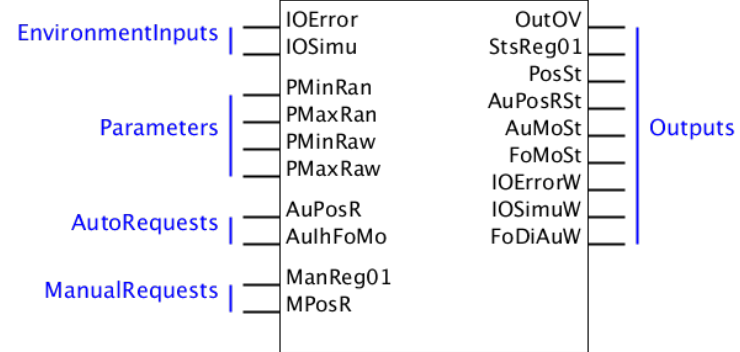
## DigitalOutput



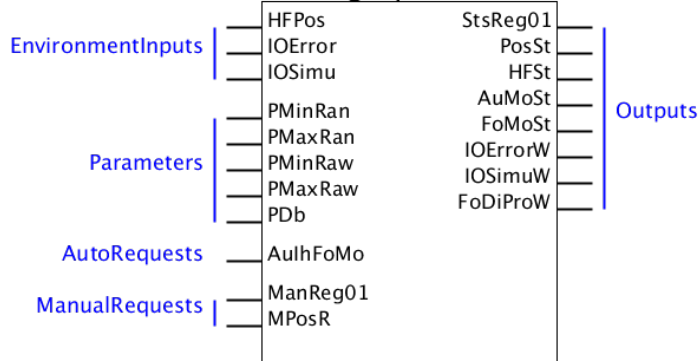
## AnalogInput



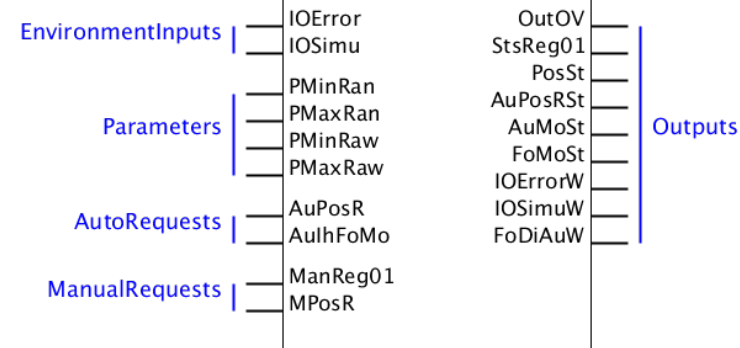
## AnalogOutput



## AnalogInputReal

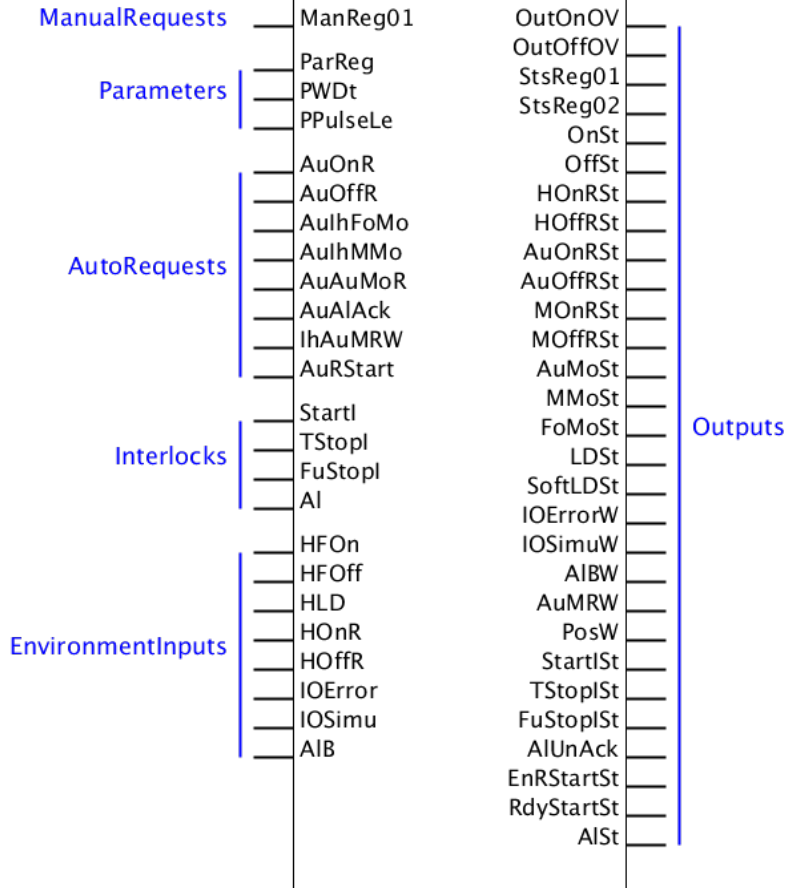


## AnalogOutputReal

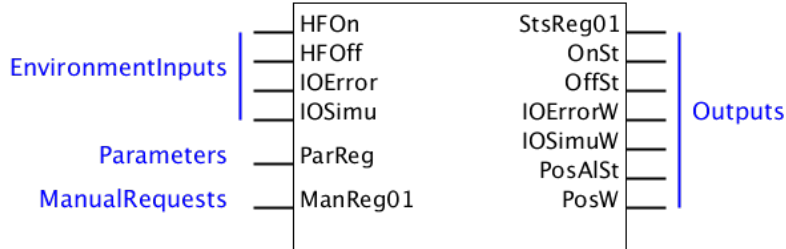


# UNICOS CPC OBJECTS. FIELD

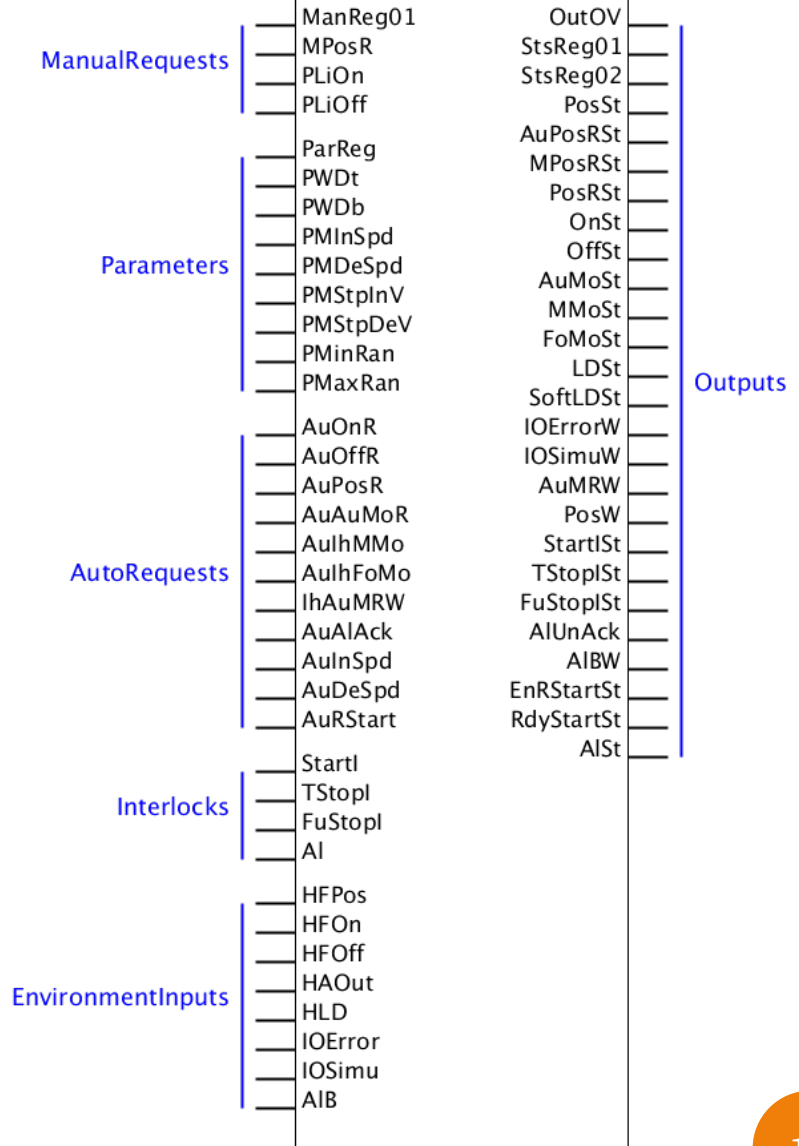
## OnOff



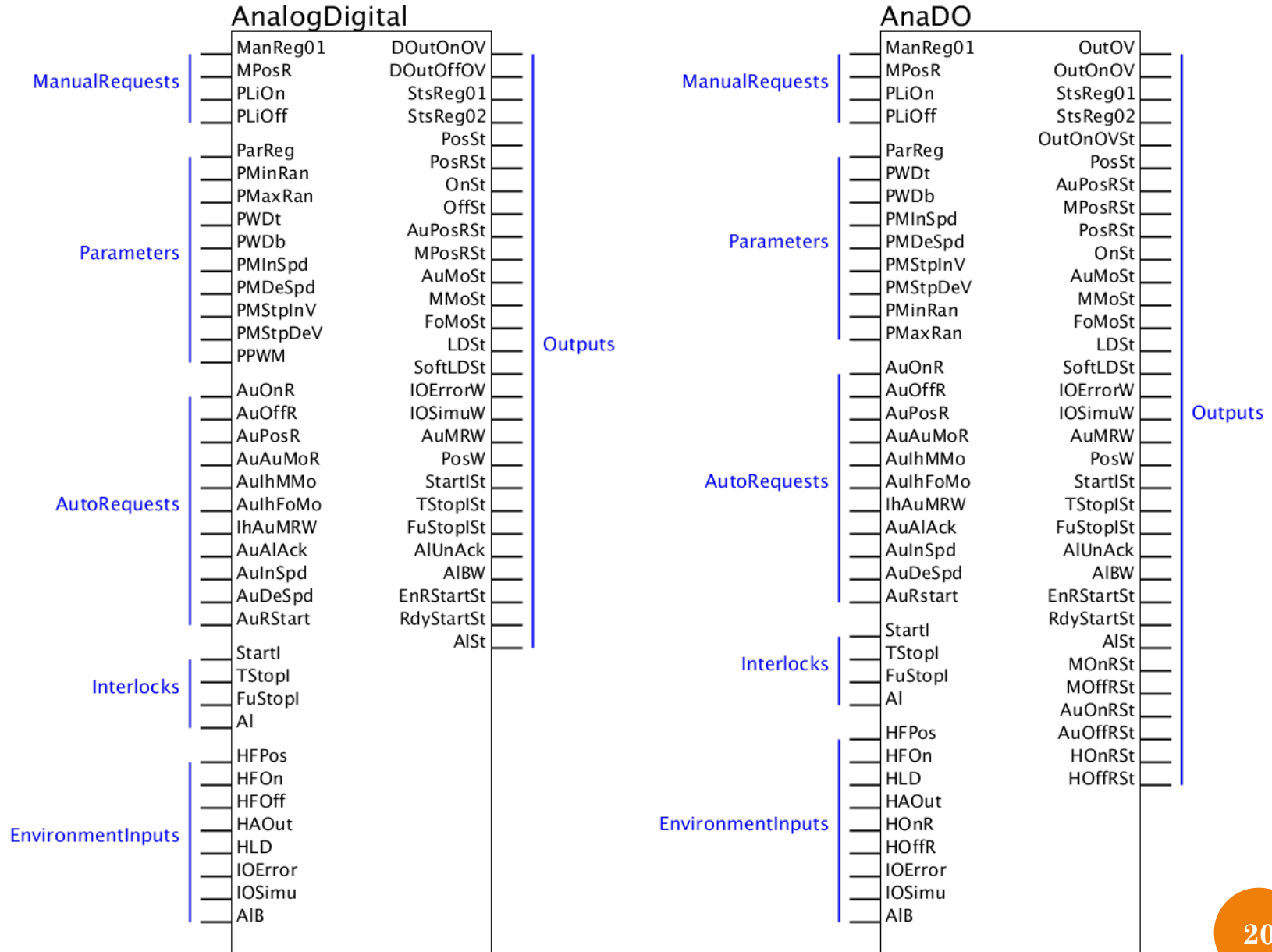
## Local



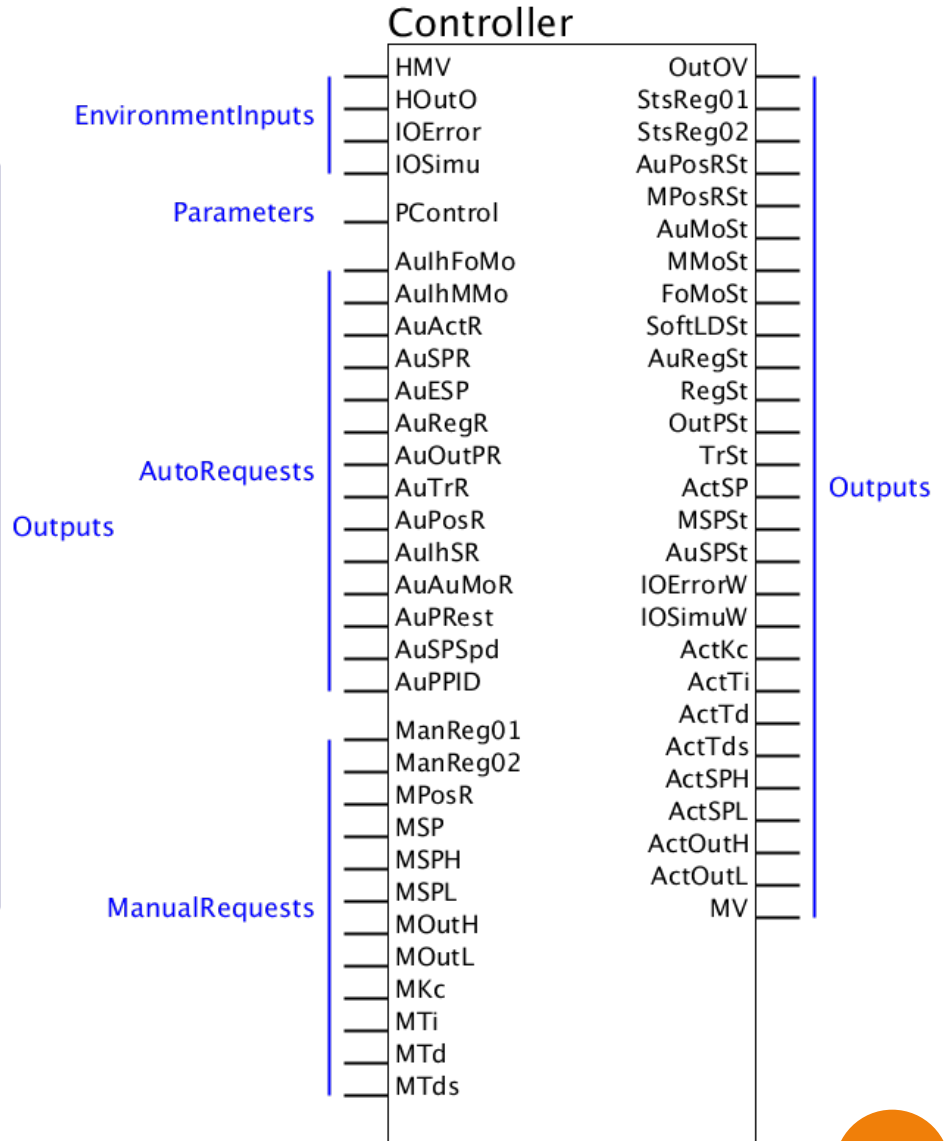
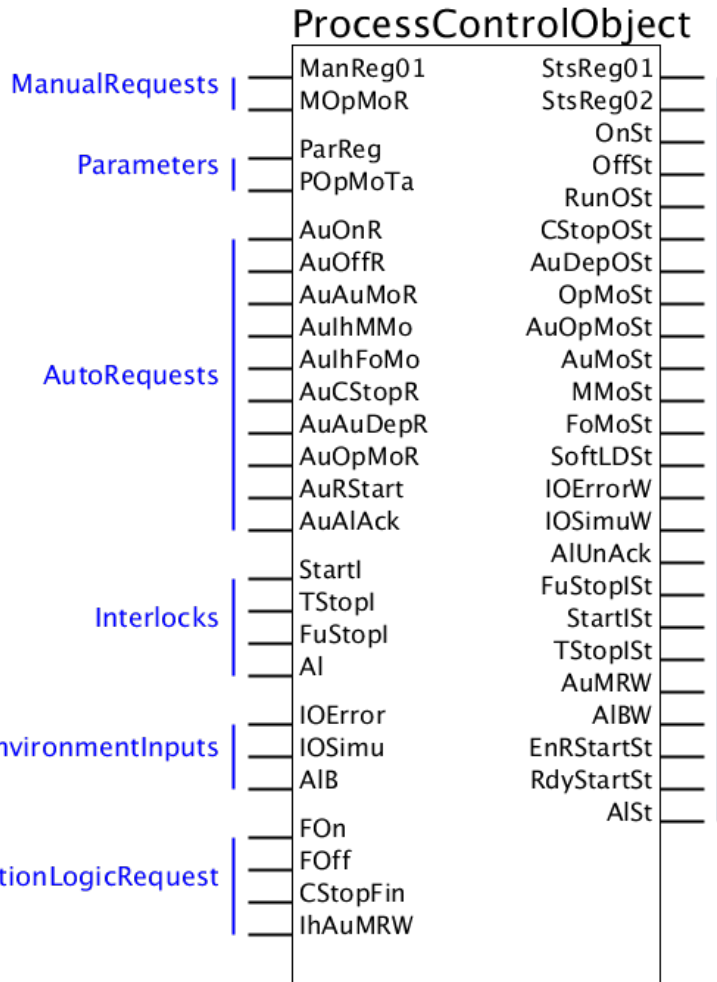
## Analog



# UNICOS CPC OBJECTS. FIELD

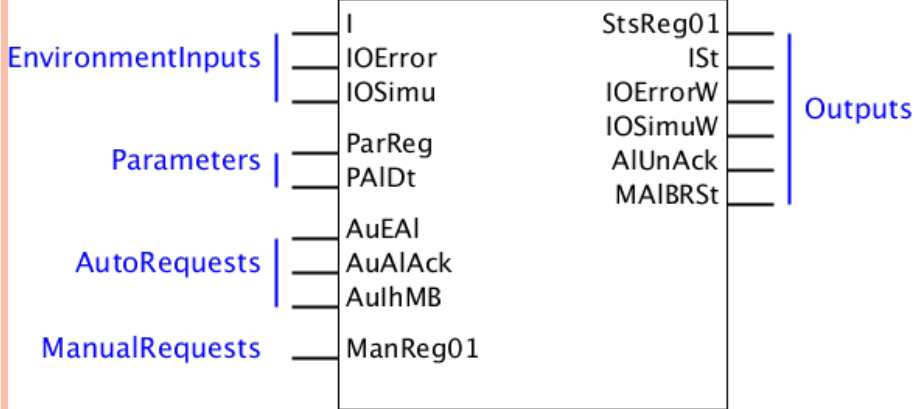


# UNICOS CPC OBJECTS. CONTROL

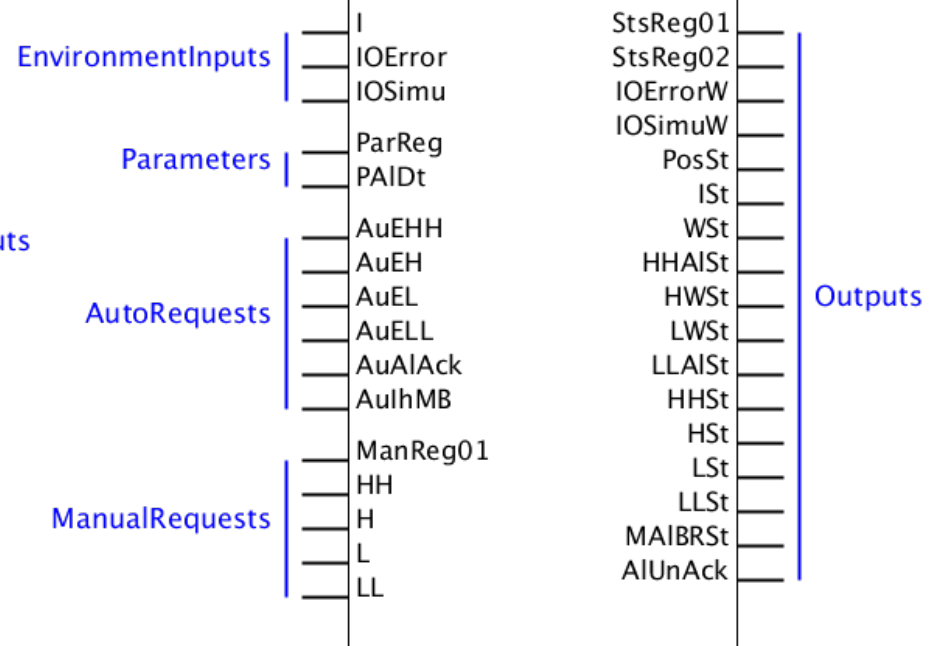


# UNICOS CPC OBJECTS. CONTROL

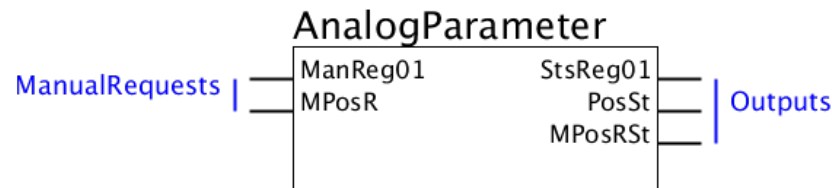
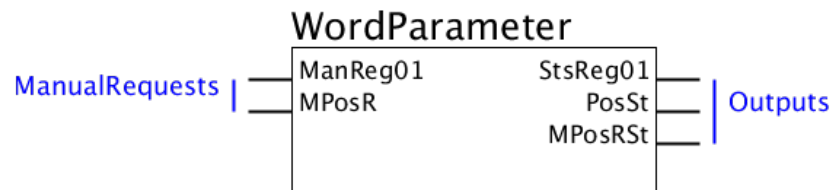
## DigitalAlarm



## AnalogAlarm



# UNICOS CPC OBJECTS. INTERFACE





# DOCUMENTATION



<http://j2eeps.cern.ch/wikis/display/UCPC16/UNICOS-CPC+Documentation>