Compax3
Compax3 Intelligent Servo Drive
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Intelligent Servo Drive Compax3

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Parker Hannifin
The global leader in motion and control technologies

A world class player on a local stage

Global Product Design
Parker Hannifin has more than 40 years experience in the design and manufacturing of drives, controls, motors and mechanical products. With dedicated global product development teams, Parker draws on industry-leading technological leadership and experience from engineering teams in Europe, North America and Asia.

Local Application Expertise
Parker has local engineering resources committed to adapting and applying our current products and technologies to best fit our customers’ needs.

Manufacturing to Meet Our Customers’ Needs
Parker is committed to meeting the increasing service demands that our customers require to succeed in the global industrial market. Parker’s manufacturing teams seek continuous improvement through the implementation of lean manufacturing methods throughout the process. We measure ourselves on meeting our customers’ expectations of quality and delivery, not just our own. In order to meet these expectations, Parker operates and continues to invest in our manufacturing facilities in Europe, North America and Asia.

Electromechanical Worldwide Manufacturing Locations
Europe
Littlehampton, United Kingdom
Dijon, France
Offenburg, Germany
Filderstadt, Germany
Milan, Italy

Asia
Wuxi, China
Chennai, India

North America
Rohnert Park, California
Irwin, Pennsylvania
Charlotte, North Carolina
New Ulm, Minnesota

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Intelligent Servo Drive Compax3

Overview

Description
Compax3 is Parker Hannifin’s global servo drive. The drive series includes single and multi axis drives as well as hydraulic controllers. It features a power range from 1 to 109 kW. The servo drives are completely developed and manufactured in Germany. An additional Compax3 production site was established in the US. As a global servo drive controller, Compax3 is of course available all over the world. Service and support sites are located in the vicinity of all major industry locations - worldwide. The “Parker Authorized Distribution Partners” do play an important role in this context - well-trained and experienced application and support specialists will provide the necessary professional support in any situation.

Features

Hardware
- Power range from 1 to 109 kW
- 1 encoder output / 1 encoder input
- 8 digitale inputs / 4 digital outputs
- 2 analog inputs (14 Bit)
- 2 analog outputs (8 Bit)
- Several fieldbuses
- Extensive safety technology

Technology Functions
- I10T10: Drive control via: velocity/torque control, step/direction input, encoder input
- I12T11: Positioning via digital I/Os, RS232/RS485, absolute/relative positioning, registration mark related positioning, electronic gearbox, dynamic positioning
- T30: Programming based on IEC61131-3 with CoDeSys
  - PLCopen function modules
  - IEC61131-3 - standard modules
  - C3-specific function modules
- T40: T30 functionality + cam function
- Technology controller with integrated Motion PLC Compax3 powerPLmC-C20

Technical Characteristics - Overview

<table>
<thead>
<tr>
<th>Device:</th>
<th>Current [A]</th>
<th>Supply voltage</th>
<th>Power [kVA]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compax3</td>
<td>I&lt;sub&gt;cont&lt;/sub&gt;, I&lt;sub&gt;peak&lt;/sub&gt; (&lt;5 s)</td>
<td>230/240 VAC</td>
<td></td>
</tr>
<tr>
<td>S025V2</td>
<td>2.5, 5.5</td>
<td>1&lt;sup&gt;+&lt;/sup&gt;</td>
<td>1.0</td>
</tr>
<tr>
<td>S063V2</td>
<td>6.3, 12.6</td>
<td>2&lt;sup&gt;+&lt;/sup&gt;</td>
<td>2.5</td>
</tr>
<tr>
<td>S100V2</td>
<td>10, 20</td>
<td>3&lt;sup&gt;+&lt;/sup&gt;</td>
<td>4.0</td>
</tr>
<tr>
<td>S150V2</td>
<td>15, 30</td>
<td>230/240 VAC</td>
<td>6.0</td>
</tr>
<tr>
<td>S015V4</td>
<td>1.5, 4.5</td>
<td>3&lt;sup&gt;+&lt;/sup&gt;</td>
<td>1.25</td>
</tr>
<tr>
<td>S038V4</td>
<td>3.8, 9.0</td>
<td>400/480 VAC</td>
<td>3.1</td>
</tr>
<tr>
<td>S075V4</td>
<td>7.5, 15</td>
<td>3&lt;sup&gt;+&lt;/sup&gt;</td>
<td>6.2</td>
</tr>
<tr>
<td>S150V4</td>
<td>15, 30</td>
<td>400/480 VAC</td>
<td>11.5</td>
</tr>
<tr>
<td>S300V4&lt;sup&gt;1)&lt;/sup&gt;</td>
<td>30, 60</td>
<td></td>
<td>25.0</td>
</tr>
<tr>
<td>H050V4</td>
<td>50, 75</td>
<td>3&lt;sup&gt;+&lt;/sup&gt;</td>
<td>35.0</td>
</tr>
<tr>
<td>H090V4</td>
<td>90, 135</td>
<td>400/480 VAC</td>
<td>70.0</td>
</tr>
<tr>
<td>H125V4</td>
<td>125, 187.5</td>
<td>(Rated voltage 560 VDC)</td>
<td>91.0</td>
</tr>
<tr>
<td>H155V4</td>
<td>155, 232.5</td>
<td>(Rated voltage 560 VDC)</td>
<td>109.0</td>
</tr>
</tbody>
</table>

<sup>1)</sup> Operation with capacitor module ModulC4.
**System Layout**

**Ethernet**

- Compax3 high performance servo drive
- Compax3 powerPLmC-C20
- XPR

**Communication channel**

- Motion control
- Compax3 powerPLmC-E30
- PIO

- Compax3S high performance servo drive
- Compax3M multi axis servo drive

**Handling actuators**

- Synchronous servo motors
- Direct drives
Compax3 System Layout

PIO

Compax3H
High Power
High Performance
Servo Drive

Compax3F
High Performance
Hydraulics
Controller

Precision Actuators

Hydraulics Components

IEC 61131-3
PLCopen
Data handling
Visualization
Communication (Process Control)
Access to all components
Project management

Communication
Multi-axis tool
C3 ServoManager
Drive Interface

IEC 61131-3
PLCopen
CamDesigner
Optimization
Setup
Diagnosis / Analysis / Maintenance
Oscilloscope

MotorManager
Motor library
Actuator library
HydraulicsManager
Valve library

Sizing Tool
SERVOsoft® (available on request)

PC Software

Parker Automation Tools
Innovative, Flexible Device Technology

The development of Compax3 was focused on maximum openness and flexibility for a wide variety of applications.

Motors / Actuators

Today, motors and actuators are available in many different versions and technologies. The Compax3 servo drives support most common motors. Among these are:

- Sine commutated synchronous and asynchronous motors
- Direct drives
  - Torque Motors
  - Linear servo motors

Feedback Systems

In this context, the Compax3 servo drives support the following feedback systems:

- Resolver
- Sine - Cosine Feedback (Single or Multiturn)
  - Hiperface interface
  - Optical and capacitive sensors
  - EnDat Interface
- Analog and digital Hall sensors
- Rotary and Linear Encoders
  - Distance coded
  - Incremental and RS422
  - EnDat Interface

Control Technology

The drive controller’s modern control technology with automatic load identification / self control as well as an observer function which can be optionally activated is a guarantor of optimized motion control under all conditions.

Communication

The support of all common Fieldbus interfaces is an essential feature of open systems. Among these are Profibus, CANopen, DeviceNet as well as the modern Ethernet based interfaces such as EtherCAT, PROFINET and Powerlink interfaces. The open OPC communication standard simplifies system integration considerably.

For dynamic, multi axis synchronized applications, a real-time drive bus is available for all drives from the Compax3 family.

Software / Tools

Simple and efficient use of a modern and complex automation component offering high functionality such as Compax3 is guaranteed by an intuitively operable software tool. The specially designed “Parker Integrated Engineering Tool”. Integral components of this software package are:

- Multi axis system management
- ServoManager
- MotorManager
- ActuatorManager
- HydraulicsManager
- CamDesigner
- IEC 61131-3 / CoDeSys – programming environment
- IEC 61131-3 – Debugger

This software tool supports the user in the configuration, the setup and optimization, the programming as well as the maintenance of all Compax3 devices. (“Software and Tools” see page 27)
System Solutions
The Compax3 series servo drives represent an important component for the design of complete automation systems. The user can chose between additional components optimally suited for the use with Compax3. Among those are:

• Operating and observing - Pop operator panels for all graphics and text applications
• Service and maintenance - BDM plug-in module
  • Change of parameters
  • Manual mode
  • Device exchange without PC
• PIO - Extension modules for the field level - external devices for digital and analog signal acquisition and control

Electromechanical overall solutions
Electromechanical system solutions play a special role today. Parker Hannifin is not only the manufacturer of modern drive and control technology, but also of

• Handling technology
• Precision Mechanics

As a special service we offer our customers complete, ready-to-mount electromechanic solutions, especially developed and manufactured for special industries or individual customers. In many cases, this reduces the development overhead on the user side considerably. Thousands of systems installed prove Parker Hannifin’s as well as their partner’s - the “Parker Automation Technology Centers” - high competence and long experience. Prefabricated integrated technology functions support the user’s tasks. Furthermore, you can extend these functions by your own know-how at any time.

Quality
Our customer systems must meet the highest demands with respect to resilience. Compax3 by Parker Hannifin exceeds by far the high quality requirements for an automation component. Not only the quality characteristics but also our customers speak volumes.

Safety
With many applications in harsh and arduous environments such as presses and robot cells, Parker ensures that product and system reliability and quality are second to none. Drive integrated systems as implemented in Compax3 support the machine designer in realizing safe and cost-efficient solutions.
Control Technology

Real-time signal processing
- Reduction of the quantization noise
- Increase of the signal resolution
  - Due to oversampling of the speed and current signals
- Online feedback error compensation of offset and gain errors
- 14 Bit resolution increase
  (Increase of the resolution of the scale graduation of up to 14 Bit)
  - By interpolation of sine-cosine feedback signals
- Determination of the speed by the observer technique
- Doubling of the controller bandwidth
  - By load torque observer principle

Jerk-limited setpoint generation, resulting in:
- Gentle handling of the moved goods
- Increased service life of mechanical components
- Overshoot free positioning
- Reduced excitation for mechanical resonance frequencies

Control:
- Controller in the feedback path helps avoid differentiating components in the numerator of the transmission function (which will result in a significant overshoot of the actual value)
- Automatic and robust controller design
  - User-oriented optimization parameters “damping” and “stiffness”
- Optimization of the response behavior
- Minimization of the following error
  - Due to feedforward of speed, acceleration, motor current and jerk
- Dual Loop Option
  - The load control can be activated via an additional feedback system for the acquisition of the actual position of the load.

Commissioning / controller optimization
- Automatic determination of the load moment of inertia
- Compax3 MotorManager for determining the motor characteristics and the motor position feedback
- Optimization with integrated oscilloscope function
Safety Technology

Integrated Safety in the Compax3

In addition to the typical tasks of motion control, a modern drive controller must also be able to perform relevant safety tasks in order to comply with the requirements of the new machinery directive 2006/42/EG. Thanks to the integrated STO - “Safe Torque OFF” safety function, you will save space and money for external power relays. It also reduces error-prone external wiring.

STO is today offered as a standard integrated into the Compax3 family servo drives. Furthermore, the Compax3M multi-axis servo drive is able to offer additional sophisticated safety functions with the aid of option card S3. For details, please see “Technical Data” “Safety technology” (page 23)

Compax3M Series Servo Drives with integrated Safety Technology as an option

Compax3 Series servo drives offer the STO (Safe Torque Off) function which helps to implement important functions, such as protection against unexpected start up as a standard. In many cases, the basic STO (Safe Torque Off) function is however no longer sufficient, as setup is frequently required while the machine is powered. For these applications, Compax3M offers option card S3, which provides the following functions in accordance with EN61800-5-2:

• SS1 - Safe Stop 1
• SS2 - Safe Stop 2
• SOS - Safe operating stop
• SLS – Safely Limited Speed
• SLP - Safely Limited Position
• SLI – Safely Limited Increment
• SDI – Safe Direction
• SSM - Safe Speed Monitor (Diagnostics output for SLS)

Increased productivity thanks to drive integrated safety technology

Hazard: Setup
Measures:
Safely limited speed (SLS)
The “safely limited speed” function monitors that the drive keeps a defined maximum speed. If the speed limit value is exceeded, the drive is safely switched off.
Safe direction (SDI)
The “safe direction” function ensures that the motion of a drive can only be in one (defined) direction. If the defined motion direction is not respected, the drive is safely switched off.

Advantages
Safe working while the protection grids are open will:
• Reduced changeover times due to a better insight into the changeover zone
• Increased working safety by guaranteeing the direction of motion as selected by jog function
• Increased working safety thanks to safely limited setup speed

Hazard: Intervention into the process
Measures:
Safe operating stop (SOS)
The “safe operating stop” function monitors the attained stop position of the axis and prevents that the position window is left. The control functions of the drive remain completely active. If the position window monitored is left, the drive is safely switched off.
Safe Stop 2 (SS2)
With the “Safe Stop 2” function, the drive is shut down in a controlled manner, after that, the “safe operating stop” is introduced. In the “safe operating stop”, the control functions of the drive remain completely active.

Advantages
Safe Operating Stop, (SOS and SS2) results in increased productivity due to:
• Axis synchronicity being maintained
• Quick and easy re-startup of the system
• Increased safety thanks to protection against unwanted startup of the system
Device Technologies

Compax3 I10T10: Step/Direction and Analog Command Input

I10T10 Scope of Functions

With its analogue interface or alternatively with step/direction or encoder step signals, the Compax3 I10T10 gives you easy and reasonably priced access to the world of servo-drive technology. Irrelevant of whether you have a PLC or PC central control unit, this remains unchanged.

The Compax3 I10T10 represents an ideal way of migrating from analog ±10 V drives to digital, intelligent servo-drives.

You can choose between the different operating modes:

±10 V Input
- ±10 V predefined speed with encoder simulation as actual value feedback
- ±10 V predefined current setpoint with encoder emulation for actual position value feedback and configurable holding functions
- Zero pulse of the emulation within a motor revolution can be freely selected

Step/Direction Command Input
- Step/direction signals as 24 V logic levels or
- With step/direction logic signals conforming to RS422

Encoder Input
- RS422
- 24 V level
Compax3 T11: Positioning

T11 Scope of Functions

Due to its high functionality, the Positioning version of Compax3 forms an ideal basis for many applications in high-performance motion automation.

- Up to 31 motion profiles can be created with the help of the PC software:
  - Absolute or relative positioning
  - Electronic Gearbox (Gearing)
  - Reg-related positioning
  - Speed control
  - Stop - Set
  - Dynamic positioning
  - Movement profiles in non-volatile flash
  - Motion profiles can be selected via field bus or digital inputs/outputs

- Wide choice of machine zero modes for your individual application
- Detection of the absolute position by distance-coded feedback
- Easy commissioning
- Guided configuration with the Compax3 ServoManager
- Flexible Optimization
- Adjustable jerk limitation
- Optional extension of the digital I/Os

Compax3 I12T11 / Motion Control:

- Via digital I/Os
- Via RS232 / RS485 with the aid of control & status word
- Up to 31 motion functions via set table
- Status bits for each motion set

Access via Compax3 inputs and outputs:

- Via digital I/Os
- Via RS232 / RS485

Compax3 I2xT11 / I3xT11 Motion Control:

- Standard profiles via PROFIBUS, PROFINET, CANopen, DeviceNet, Ethernet Powerlink and EtherCAT
- Direct set specification via fieldbus telegrams or
- Set selection (31 motion sets)
- Status bits for each motion set
- Operating modes:
  - Speed controller, direct positioning, positioning via set selection

Characteristics:

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Description</th>
<th>Baud rate</th>
<th>Data Size</th>
<th>Nodes</th>
<th>Cycle time</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROFIBUS</td>
<td>ProfiDrive Profile drive system V3</td>
<td>up to 12 Mbit/s</td>
<td>up to 32 bytes</td>
<td>up to 63 slaves</td>
<td>from 500 µs</td>
</tr>
<tr>
<td>PROFINET</td>
<td>ProfiDrive profile drive technology V4.1</td>
<td>up to 12 Mbit/s</td>
<td>up to 32 bytes</td>
<td>up to 63 slaves</td>
<td>from 125 µs</td>
</tr>
<tr>
<td>CANopen</td>
<td>MotionControl CiADS402</td>
<td>20...1000 Kbit/s</td>
<td>up to 32 bytes</td>
<td>up to 63 slaves</td>
<td>from 500 µs</td>
</tr>
<tr>
<td>DeviceNet</td>
<td></td>
<td>125...500 Kbit/s</td>
<td>up to 63 slaves</td>
<td>up to 63 slaves</td>
<td>from 125 µs</td>
</tr>
<tr>
<td>Ethernet Powerlink</td>
<td>MotionControl CiADS402</td>
<td>100 Mbit/s (FastEthernet)</td>
<td>up to 63 slaves</td>
<td>up to 63 slaves</td>
<td>from 125 µs</td>
</tr>
<tr>
<td>EtherCAT</td>
<td></td>
<td>100 Mbit/s (FastEthernet)</td>
<td>up to 63 slaves</td>
<td>up to 63 slaves</td>
<td>from 125 µs</td>
</tr>
</tbody>
</table>

- Statusword
- Position
- Torque
- Speed
Motion Function:

Absolute / Relative Positioning: MoveAbs and MoveRel
- A motion set defines a complete motion with all settable parameters.
  - (1) Target position
  - (2) Travel speed
  - (3) Maximum Acceleration
  - (4) Maximum deceleration
  - (5) Maximum Jerk

Reg-related positioning:
RegSearch, RegMove
- For registration mark-related positioning, 2 motions are defined.
  - RegSearch: Search of an external signal - a reg, e.g. a mark on a product
  - RegMove: The external signal interrupts the search movement and the second movement by an offset follows without transition
- Accuracy of the reg detection: <1 µs

Electronic Gearbox:
Gearing
- Synchronous motion to a leading axis with any transmission ratio.
  The position of a master axis can be detected via:
  - +/-10 V analog input
  - Step / direction input
  - the encoder input or
  - HEDA, with Compax3 master

Dynamic positioning
- You can switch to a new motion profile during a positioning sequence - a dynamic transition takes place.

Speed control:
Velocity
- Defined via speed and acceleration.

Stop movement:
Stop
- The Stop set interrupts the current motion set.

Entry of motion sets
Compax3 T30: IEC 61131-3 Positioning with function modules based on PLCopen

T30 Scope of Functions

- Programming in accordance with IEC 61131-3
- Programming system: CoDeSys
- up to 6000 instructions
- 650 16bit variables / 200 32bit variables
- Recipe table with 288 variables
- 3 16-bit retain variables / 3 32-bit retain variables
- Inputs/outputs:
  - 8 digital inputs (24 V level)
  - 4 digital outputs (24 V level)
  - 2 analog inputs (14 Bit)
  - Optional extension of 12 inputs/outputs

- IEC 61131-3 standard modules:
  - Up to 8 timers (TON, TOF, TP)
  - Triggers (R_TRIG, F_TRIG)
  - Flip-flops (RS, SR)
  - Counters (CTU, CTD, CTUD)

- Device-specific function modules:
  - C3_Input: Generates an input process image
  - C3_Output: Generates an output process image
  - C3_ReadArray: Access to recipe table
  - Force control on request

- PLCopen function modules:
  - Positioning: absolute, relative, additive, continuous
  - Machine Zero
  - Stop, energizing the power stage, Quit
  - Position, device status, reading axis error
  - Electronic gearbox (MC_Gearln)

Compax3 Function Blocks

- Absolute Positioning
- Stop
- Reading axis error
- Relative Positioning
- Machine Zero
- Acknowledging errors
- Additive positioning
- Energizing the power stage
- Reading the current position
- Continuous positioning
- Reading device status
- Electronic Gearbox (Gearing)

Example of an IEC 61131 application controlled by means of a bus interface:

- 2 control words are placed on the cyclic channel of the bus.
- The position data records (position, speed, acceleration, ... are stored in a table (array).
- The desired position data record is selected with Controlword_2.
- The individual bits of Controlword_1 control positioning.
- A return message is given through a status word on the cyclic channel of the bus.
Compax3 T40: IEC 61131-3 positioning with cam function modules

T40 Scope of Functions:

Compax3 T40 is able to simulate mechanical cams and cam switching mechanisms electronically. The “Electronic Cam - T40 was especially optimized for

• Packaging Machinery,
• Printing Industry as well as
• all applications where a mechanical cam is to be replaced by a flexible, cyclic electronic solution. This helps to realize discontinuous material supply, flying knife and similar drive applications with distributed drive performance. Compax3 T40 supports both real and virtual master movements. In addition, the user can switch to other cam profiles or cam segments on the fly.

Programming is carried out in the IEC 61131-3 environment.

Cam applications can be easily implemented with the aid of the cam function modules and the CamDesigner.

T40 Function Overview:

• T30 Technology Functions completely integrated and available
• Master position acquisition
• Reg synchronization
• Electronic Cam switches
• Coupling and decoupling functions
• Cam profiles
• Cam memory
• Cam creation with the CamDesigner

Cutting on the fly

Diagonal-beam sawing

Machining during motion
Master Position Acquisition
- Acquisition via SSI encoder or incremental encoder
- Acquisition by the HEDA real-time bus
- Virtual master:
  - A second axis in the IEC - program can be used to program a motion profile which serves as a master for one or several slaves

Reg Synchronization
- Master or slave oriented (simultaneous, cam-independent)
- Highly precise reg mark recognition (accuracy < 1 µs; Touchprobe)

Cam Memory
- 10,000 points (master / slave) in 24 bit format
- High-precision profile generation:
  - Non equidistant interpolation points of the master and slave coordinates (stored fail-safe)
  - Linear interpolation between interpolation points
- Cam memory for up to 20 curves

Coupling and Decoupling Functions
- By means of a setpoint generator
- By means of a change-over function
- Without overspeeding by coupling over several master cycles
- Virtually free set-up of the coupling and decoupling movement
- Master-guided coupling movement
- Random standstill position

Cam Profiles
- Up to 20 cam segments can be produced by:
  - Virtually random cam links (forwards and backwards)
  - Freely programmable event-controlled cam branches
  - Scalable cam segments and complete cam profiles

Cam Controller
- 36 cams with individual profiles.
- 4 fast cams (125 µs per cam) standard: 500 µs.
- 32 serial cams, 16 ms/cam cycle (0.5 ms/cam).
- Delay-time compensated cams: Compax3 can advance the cam to compensate for delays in switching elements.
Compax3 - C3 powerPLmC Control Technology

C3 powerPLmC: Control of individual and multiple axes

Description
Modern machines feature high flexibility and productivity. Automation solutions from Parker Hannifin offer the basis for the implementation of state-of-the-art machine concepts. The consequent integration of international standards provides OEMs with the freedom to concentrate entirely on the technological process.

The motion control plays an increasingly central role in this development.

Features
- Basis for the implementation of modular machine concepts
- Windows® based standard tools for programming, start-up and diagnostics
- Minimization of the wiring overhead by reduction of the interface diversity
- Maximum functionality and flexibility
- Optimized space requirements due to minimized components and state-of-the-art installation concept
- Realization of safe machine concepts
- Basis for the realization of hybrid machine concepts - electromechanics, hydraulics and pneumatics
Compax3 T30 / T40 Technology Controller

Main fields of application
- Machines or machine modules with one or two servo axes
- Applications requiring a high degree of flexibility with respect to sequence control
- Optional connection of upgrading devices for the operation and monitoring as well as external I/Os

Technology controller with integrated Motion PLC - Compax3 powerPLmC-C20

Main fields of application
- More than two axes for motion automation
- High degree of system integration (e.g. via Ethernet)
- Integration of complex devices for machine visualization and operation
- Connection to a wide number of digital and analog inputs
- Integration of pneumatic and hydraulic automation devices

Motion PLC with Technology Functions - C3 powerPLmC-E30

Main fields of application
- As Compax3 powerPLmC-C20
- High proportion of PLC typical tasks
- Integration of additional automation components via a second CAN bus
- Basis for the realization of hybrid machine concepts electromechanics, hydraulics and pneumatics
### Controller Characteristics

<table>
<thead>
<tr>
<th>Model</th>
<th>Compax3 powerPLmC-C20</th>
<th>C3 powerPLmC-E30</th>
<th>Compax3 T30 / T40</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General information</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Platform</td>
<td>32 Bit RISC processor 200 MHz</td>
<td></td>
<td>24 Bit Signal processor</td>
</tr>
<tr>
<td>Boot FLASH / Program memory FLASH</td>
<td>1 MB / 4 MB</td>
<td>64 MB compact flash</td>
<td>-</td>
</tr>
<tr>
<td>Data memory SDRAM / Data memory non volatile</td>
<td>16 MB / 32 kB (Retain)</td>
<td>64 kB / 18 Byte (Retain)</td>
<td></td>
</tr>
<tr>
<td>Real time Clock</td>
<td>Yes, battery backed</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Operating system / supply</td>
<td>Real-time multitasking / 24 VDC</td>
<td>Single tasking</td>
<td></td>
</tr>
<tr>
<td><strong>Controller features</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processing time</td>
<td>&lt;100 µs for 1000 IL rows</td>
<td></td>
<td>2 ms for 1000 AWL rows</td>
</tr>
<tr>
<td>Real time tasks</td>
<td>Coasting</td>
<td>Cyclical</td>
<td></td>
</tr>
<tr>
<td>Event-controlled, internal / external events</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimal cycle time</td>
<td>Typical 1 ms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online Program Change</td>
<td>Yes</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Watchdog Timer</td>
<td>Yes</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Data exchange in distributed systems (network variables)</td>
<td>Yes</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td><strong>Programming and debugging</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Programming system</td>
<td>CoDeSys</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Programming languages</td>
<td>IL, SFC, FBP, ST, LD, CFC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protocol</td>
<td>IEC 61131-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLCopen - Motion control modules</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Debug, single step, watch function</td>
<td>Yes</td>
<td>Yes (no single step)</td>
<td></td>
</tr>
<tr>
<td>Simulation, online trace</td>
<td>Yes</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Breakpoints</td>
<td>Yes (source level debugging)</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Source code download</td>
<td>Yes</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Write, read, force variables</td>
<td>Yes</td>
<td>Yes (no forcing)</td>
<td></td>
</tr>
<tr>
<td>Program administration</td>
<td>File - System, FTP</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Programming interface</td>
<td>Fast Ethernet</td>
<td></td>
<td>RS232</td>
</tr>
<tr>
<td><strong>Visualization</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Locally on the programming system</td>
<td>Yes</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Web Server</td>
<td>Yes</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>OPC Server</td>
<td>Yes</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td><strong>Interfaces</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>general</td>
<td>RS232/RS485</td>
<td>2x RS232</td>
<td>RS232/RS485</td>
</tr>
<tr>
<td>Fieldbuses (standard)</td>
<td>CANopen-Master Ethernet 10/100</td>
<td>2x CANopen Master Ethernet 10/100 Modbus TCP/IP Server</td>
<td>CANopen Master for the connection of PIOs (input/ output modules)</td>
</tr>
<tr>
<td>Fieldbuses (optional)</td>
<td>PROFIBUS DP Slave</td>
<td>PROFIBUS DP Slave</td>
<td>HEDA: Real-time data bus</td>
</tr>
<tr>
<td>Digital and analog inputs/outputs Option</td>
<td>Any</td>
<td>Any (depending on the number of axes)</td>
<td>24 digital / 4 analog</td>
</tr>
<tr>
<td>Encoder output</td>
<td>Yes, up to 16384/revolutions</td>
<td>No</td>
<td>Yes, up to 16384/revolutions</td>
</tr>
</tbody>
</table>

Compax3
Device Technologies
Compax3F: Hydraulics Controller

The Compax3F hydraulics controller is another member of the Compax3 family based on the well-known Compax3 digital drive. Thus, all advantages offered by the Compax3 family are now also available in servo- and proportional hydraulics. The hydraulics controller is available with the following technologies:

**Technology Functions**
- T11: Positioning
- T30: Motion control programmable in accordance with IEC 61131-3
- T40: Electronic cam

**Inputs and outputs**
- 8 control inputs: 24 VDC / 10 kOhm
- 4 control outputs: Active HIGH / short-circuit proof / 24 V / 100 mA
- 4 analog current inputs: 14 Bits
- 2 analog voltage inputs: 14 Bits
- 4 analog outputs: 16 Bits, current or voltage
- 2 analog monitor outputs: 8 bits

**Communication**
- RS232: 115,200 Bauds
- RS485 (2 or 4-wire): 9600, 19,200, 38,400, 57,600 or 115,200 Bauds

**Feedback**
- 1 Vpp SineCosine (max. 400 Hz)
- RS422 Encoder (max. 5 MHz, or Step/Direction)
- SSI (RS422)
- Start / Stop (Time of Flight, RS422)
- EnDat2.1, EnDat2.2

**Size / Weight**
- HxWxD [mm]: 199x80x130
- Weight [kg]: 2.0

**Housing / protection class**
- Enclosed metal housing, IP20

**Your Advantage:**
- It is no longer necessary to distinguish between the motion of a hydraulic or an electromechanical axis on the control technology level.
- Common software tools for electromechanics and hydraulics supporting the design of hybrid machines. Especially the combination with the highly dynamic DFplus valve can be used to efficiently increase your machine performance.

**Example: System Layout**

PROFIBUS and PROFINET are registered trademarks of PROFIBUS & PROFINET International (PI). EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.
## Technical Characteristics

### Compax3S

<table>
<thead>
<tr>
<th>Compax3</th>
<th>S025V2</th>
<th>S063V2</th>
<th>S100V2</th>
<th>S150V2</th>
<th>S015V4</th>
<th>S038V4</th>
<th>S075V4</th>
<th>S150V4</th>
<th>S300V4 (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply and device currents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply [V]</td>
<td>1°230/240 VAC (80...253 VAC) / 50...60 Hz</td>
<td>3°230/240 VAC (80...253 VAC) / 50...60 Hz</td>
<td>3°400/480 VAC (80...528 VAC) / 50...60 Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output nominal current (rms) [A]</td>
<td>2.5</td>
<td>6.3</td>
<td>10</td>
<td>15</td>
<td>1.5</td>
<td>3.8</td>
<td>7.5</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>Peak current (&lt;5 s) [A]</td>
<td>5.5</td>
<td>12.6</td>
<td>20.0</td>
<td>30.0</td>
<td>4.5</td>
<td>9.0</td>
<td>15.0</td>
<td>30.0</td>
<td>60.0</td>
</tr>
<tr>
<td>Power [kVA]</td>
<td>1.0</td>
<td>2.5</td>
<td>4.0</td>
<td>6.0</td>
<td>1.25</td>
<td>3.1</td>
<td>6.2</td>
<td>11.5</td>
<td>25.0</td>
</tr>
<tr>
<td>Control voltage [V]</td>
<td>24 VDC ±10 %, ripple &lt;1 Vpp</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric current drain [A]</td>
<td>0.8 A (Compax3) (+ digital outputs 0.1 A each + motor brake up to 1.6 A)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Dynamic Brake

| Capacitance [µF] | 560 | 1120 | 780 | 1170 | 235 | 235 | 470 | 690 | 1100 |
| Storable energy [Ws] | 15 @230 V | 30 @230 V | 21 @230 V | 31 @230 V | 37@400 V | 37@400 V | 37@400 V | 75@400 V | 110@400 V |
|                     | 32@480 V | 21@480 V | 21@480 V | 42@480 V | 61@480 V | 176@480 V |
|                     | 37@400 V | 21@480 V | 21@480 V | 42@480 V | 61@480 V | 176@480 V |
|                     | 37@400 V | 21@480 V | 21@480 V | 42@480 V | 61@480 V | 176@480 V |
|                     | 75@400 V | 42@480 V | 42@480 V | 42@480 V | 42@480 V | 42@480 V |
|                     | 110@400 V | 61@480 V | 61@480 V | 61@480 V | 61@480 V | 61@480 V |
|                     | 176@480 V | 176@480 V | 176@480 V | 176@480 V | 176@480 V | 176@480 V |

(1) Operation with capacitor module ModulC4.

### Compax3H

<table>
<thead>
<tr>
<th>Compax3</th>
<th>H050V4</th>
<th>H090V4</th>
<th>H125V4</th>
<th>H155V4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply and device currents</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply [V]</td>
<td>3°400/480 VAC (350...528 VAC) / 50...60 Hz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output nominal current (rms) [A]</td>
<td>50.0</td>
<td>90.0</td>
<td>125.0</td>
<td>155.0</td>
</tr>
<tr>
<td>Peak current (&lt;5 s) [A]</td>
<td>75.0</td>
<td>135.0</td>
<td>187.5</td>
<td>232.5</td>
</tr>
<tr>
<td>Power [kVA]</td>
<td>35.0</td>
<td>70.0</td>
<td>91.0</td>
<td>109.0</td>
</tr>
<tr>
<td>Control voltage [V]</td>
<td>24 VDC ±10 %, ripple &lt;1 Vpp</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric current drain [A]</td>
<td>0.8 A (Compax3) (+ digital outputs 0.1 A each + motor brake up to 1.6 A)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Dynamic Brake

| Capacitance [µF] | 2600 | 3150 | 5000 | 5000 |
| Storable energy [Ws] | 602@400 V | 729@400 V | 1158@400 V | 1158@400 V |
|                     | 419@480 V | 507@480 V | 806@480 V | 806@480 V |
|                     | 74@400 V | 42@480 V | 74@400 V | 42@480 V |

### Compax3M

<table>
<thead>
<tr>
<th>Compax3</th>
<th>M050D6</th>
<th>M100D6</th>
<th>M150D6</th>
<th>M300D6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply and device currents</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply [V]</td>
<td>325...679 VDC (Rated voltage 560 VDC)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output nominal current (rms) [A]</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>Peak current (&lt;5 s) [A]</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td>Power [kVA]</td>
<td>3.33</td>
<td>6.66</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Dynamic Brake</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacitance [µF]</td>
<td>110</td>
<td>220</td>
<td>220</td>
<td>440</td>
</tr>
<tr>
<td>Storable energy [Ws]</td>
<td>18@400 V</td>
<td>37@400 V</td>
<td>37@400 V</td>
<td>74@400 V</td>
</tr>
<tr>
<td></td>
<td>10@480 V</td>
<td>21@480 V</td>
<td>21@480 V</td>
<td>42@480 V</td>
</tr>
</tbody>
</table>
### Technical Characteristics

#### Positioning

- **Positioning on the motor shaft**

  - **Resolver (option F10)**
    - Resolution: 16 Bit (= 0.005°)
    - Absolute accuracy: +/-0.167°

  - **SinCos® (Option F11)**
    - Position resolution: 13.5Bit/Encoder sine period => 0.03107°/encoder resolution

  - **Direct drives (F12)**
    - Maximum position resolution:
      - Linear: 24 bits per motor magnet spacing
      - Rotary: 24 bits per motor revolution
    - For 1 Vpp sine-cosine encoders (e.g. EnDat): 13.5 bits / graduation of the encoder scale. For RS422 encoders: 4xEncoder resolution / Encoder Bypass possible. Accuracy of the feedback zero pulse acquisition = accuracy of the feedback resolution. For analog hall sensors with 1 Vpp signal: 13.5 bits / motor magnet spacing

  The exactitude of the position signal is above all determined by the type and exactitude of the feedback system used.

#### Setpoint generator

- **Jerk-limited ramps**
- **Travel data in increments, mm, inch or variable by scale factor**
- **Specification of speed, acceleration, deceleration and jerk**

#### Monitoring functions

- **Power/auxiliary supply range**
- **Motor power stage temperature/stall protection**
- **Following error monitoring**

---

### PSUP Mains module

#### Mains Module

<table>
<thead>
<tr>
<th>Mains Module</th>
<th>Unit</th>
<th>PSUP10</th>
<th>PSUP20</th>
<th>PSUP30 (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>VAC</td>
<td>230</td>
<td>400</td>
<td>480</td>
</tr>
<tr>
<td>Output Voltage</td>
<td></td>
<td>230</td>
<td>400</td>
<td>480</td>
</tr>
<tr>
<td>Power supply</td>
<td>[kVA]</td>
<td>6</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Output power</td>
<td>[kVA]</td>
<td>12</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Pulse power (&lt;5 s)</td>
<td>[kVA]</td>
<td>24</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Control voltage</td>
<td></td>
<td>24 VDC ±10 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum ripple</td>
<td></td>
<td>&lt;1 Vpp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric current drain</td>
<td></td>
<td>0.2 A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Voltage</td>
<td></td>
<td>C3M100D6: 0.85 A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output power</td>
<td></td>
<td>C3M150D6: 0.85 A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse power (&lt;5 s)</td>
<td></td>
<td>C3M300D6: 1.0 A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) Operation of the PSUP30 only with line choke “Required line choke for the PSUP30: 0.45 mH / 55 A” see page 31

### Safety Technology

- **Compax3S**
  - STO (Safe torque off) in accordance with EN ISO 13849:2008, category 3:PL=d/e.
  - Certified: BG-PRÜFZERT

- **Compax3M**
  - Standard S1
  - STO (Safe torque off) in accordance with EN ISO 13849:2008, category 3:PL=e. Certified: BG-PRÜFZERT
  - Enhanced (S3 Option)
    - The Compax3M device with option S3 complies with the requirements of the test principles (Kat. 4 / PL e PL=e to EN ISO 13849-1, SIL CL 3 in accordance with EN61800-5-1 /EN 62061 / EN 61508) and may be used in applications up to cat. 4 / PL e in accordance with EN ISO 13849-1 and SIL 3 in accordance with EN 62061 / EN 61508.

---

(1) Operation of the PSUP30 only with line choke “Required line choke for the PSUP30: 0.45 mH / 55 A” see page 31
Compax3
Technical Characteristics

Supported Motor and Feedback Systems

**Motors**

- Sinusoidally commutated synchronous motors
  - Maximum electrical turning frequency: 1000 Hz
  - Maximum velocity at 8 pole motors: 15,000 min⁻¹
  - Maximum speed: 60°1000/number of pole pairs in min⁻¹
- Sinusoidal commutated asynchronous motors
  - Maximum electrical turning frequency: 1000 Hz
  - Maximum speed: 60°1000/number of pole pairs - slip in min⁻¹
- 3 phase synchronous direct drives

**Feedback systems**

Option F10 for
- Resolver
  - Tamagawa: 2018N321 E64
  - Siemens: 23401-T2509-C202

Option F11 for
- Sine Cosine - Encoder with Hiperface® -
  - Rotary feedback with HIPERFACE® interface in Single or Multiturn version (absolute position up to 4096 motor revolutions):
  - For example: SRS/M50, SRS/M50S, SKS/M36, SEK52, SEL57, SEK37, SEL37, SEK 90/180/260

Option F12 for
- EnDat 2.1 or EnDat 2.2 feedback systems with/without incremental track (sine-cosine track)
  - Rotary feedback in Single or Multiturn version (absolute position up to 4096 motor revolutions);
  - Linear feedbacks
- Analog hall sensors
  - Sine - cosine signal (max. 5 VSS; typical 1 VSS) 90° offset
  - U-V Signal (max. 5 VSS; typical 1 VSS) 120° offset
- Linear or rotary encoders
  - U-V Signal (max. 5 VSS; typical 1 VSS) (max. 400 kHz) or
  - TTL (RS422) (max. 5 MHz) with the following modes of commutation:
    - Automatic commutation or digital hall sensors
- Distance coded feedback systems
  - Distance coding with 1VSS interface
  - Distance coding with RS422 - Interface
- Feedback error compensation: Automatic feedback error compensation

**Ambient Conditions**

**Temperature range**

<table>
<thead>
<tr>
<th>Compax3S &amp; Compax3H</th>
<th>PSUP / Compax3M</th>
</tr>
</thead>
<tbody>
<tr>
<td>0...45 °C</td>
<td>0...40 °C</td>
</tr>
</tbody>
</table>

**Tolerated humidity**

| max. relative air humidity <=85% class 3K3; non-condensing |

**Elevation of operating site**

- ≤1000 m asl for 100 % load ratings
- ≤2000 m above sea level for 1 % / 100 m power reduction
- please inquire for greater elevations

**Degree of protection**

| IP20 protection level in accordance with EN 60529 |
## Technical Characteristics

### Standards and Conformance

#### Insulation requirements
- Protection class in accordance with EN 60664-1
- Protection against human contact with dangerous voltages: in accordance with EN 61800-5-1
- Overvoltage: Voltage category III in accordance with EN 60664-1
- Level of contamination 2 in accordance with EN 60664-1 and EN 61800-5-1

#### CE compliance
- EG low voltage directive 2006/95/EC EN 61800-5-1, Standard for electric power drives with settable speed; requirements to electric safety EN 60664-1, isolation coordinates for electrical equipment in low-voltage systems EN 60204-1, Machinery norm, partly applied
- EC-EMC-directive 2004/108/EC EN 61800-3, product standard for speed adjustable drives

#### UL certification
- UL conform according to UL508C
  - Compax3S: Recognized Component Mark for Canada and the US
  - PSUP / Compax3M & Compax3H: UL Listing

#### RoHS Compliance

### Ports

#### COM ports
- RS232, 115200 Baud
- RS485, (2- or 4-wire) 9600, 19200, 38400, 57600 or 115200 Bauds
- USB (Compax3M), USB 2.0 Full Speed compatible

#### Bus systems
- PROFIBUS DP V0-V2 (I20), 12 Mbit/s, PROFl drive profile drive technology
- CANopen (CiADS402) (I21), 20...1000 Kbit/s, SDO1, PDO1, ... PDO4
- DeviceNet (I22), up to 32 bytes I/O, 125...500 Kbit/s, up to 63 slaves
- Ethernet Powerlink (I30), 100 Mbit/s (FastEthernet), from 500 μs (typ. 1 ms) cycle time
- EtherCAT (I31), 100 Mbit/s (FastEthernet), from 125 μs (typ. 1 ms) cycle time
- PROFINET (I32) certified, PROFINET IO (RT), 100BASE-TX (Full Duplex)

#### Inputs and outputs
- 8 control inputs: 24 VDC / 10 kOhm
- 4 control outputs: Active HIGH / short-circuit proof/ 24 V / 100 mA
- 2 analog inputs (14 Bit)
- 2 analog outputs (8 Bit)

#### Encoder simulation
- 4-16384 increments per revolution (zero pulse can be freely selected within one motor revolution)
- Limit frequency: 620 kHz
## Dimensions

### Compax3S

![Compax3S Diagram](image)

<table>
<thead>
<tr>
<th>Device:</th>
<th>Dimensions [mm]</th>
<th>Weight [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>S025V2</td>
<td>216 84 172 203</td>
<td>2.0</td>
</tr>
<tr>
<td>S063V2</td>
<td>100 158 259</td>
<td>2.5</td>
</tr>
<tr>
<td>S100V2</td>
<td>115 158 259</td>
<td>4.3</td>
</tr>
<tr>
<td>S150V2 / S150V4</td>
<td>273 84 172 259</td>
<td>6.8</td>
</tr>
<tr>
<td>S015V4</td>
<td>100 115 259</td>
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<td>115 203 259</td>
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<td>S300V4</td>
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### Compax3H

![Compax3H Diagram](image)

<table>
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<tr>
<th>Device:</th>
<th>Dimensions [mm]</th>
<th>Weight [kg]</th>
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<tbody>
<tr>
<td>H050V4</td>
<td>453 252 245</td>
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<td>H090V4</td>
<td>669 257 312</td>
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<td>H125V4</td>
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<td>H155V4</td>
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### PSUP & Compax3M

![PSUP & Compax3M Diagram](image)

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<th>Device:</th>
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<tr>
<td>M050D6</td>
<td>360 50 263</td>
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<td>M100D6</td>
<td>360 50 263</td>
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<tr>
<td>M150D6</td>
<td>360 50 263</td>
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<td>M300D6</td>
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### Mains Module

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<td>PSUP20D6</td>
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</tr>
<tr>
<td>PSUP30D6</td>
<td>360 100 263</td>
<td>6.3</td>
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### Enclosure

- **Insulation:** VDE 0160 / Protection class IP20 in accordance with EN 60 529 (not for C3H1xxV4)
Accessories and Options

Software and Tools

C3 ServoManager
- Guided configuration
- Automatic querying of all necessary entries
- Graphical support
- Setup mode
  - Manual motion of individual axes
  - Predefined profiles
  - Convenient operation
  - Storage of defined profiles
  - Automatic determination of the moment of inertia
- integrated 4-channel oscilloscope
  - Signal tracking directly on the PC
  - Various modes (single/normal/auto/roll)
- Zoom function
- Export as image or table (for example to Excel)

MotorManager
- Complete library for Parker motors
- Integration of customer motors
- Determination of motor characteristics and of the motor position feedback

CamDesigner
Cam creation tool
- Standard and expert mode
- Evaluation of the motion profiles
- Verification of the drive selection
- Transition laws from the VDI directive 2143

HydraulicsManager
- Valve library for Parker valves
- Integration of customer valves

Programming

CoDeSys
CoDeSys is a development environment for programming that saves a significant amount of time as applications are created.
- Powerful developing environment, worldwide established
- Universal programming platform for various devices
- Complete offline simulation
- Visual elements
- Library management for user-defined applications
- Context-sensitive help wizard
- Data exchange between devices from different manufacturers
- Complete online functionality
- Sophisticated technological features
- Free of charge

IEC61131-3
IEC 61131-3 is the only company- and product independent programming language with worldwide support for industrial automation devices.
IEC 61131-3 includes graphical and textual programming languages:
- Instruction list
- Structured text
- Ladder diagram
- Sequential function chart
- Function block diagram
- Integrated standards offer:
  - a trusted programming environment
  - standardized programming
- Integrated standards reduce:
  - the overhead of development
  - maintenance costs
  - software upkeep
  - training overhead
- Integrated standards increase:
  - productivity
  - software quality
  - concentration on core competence

PLCopen
PLCopen is an organization that plays a significant role in supporting the IEC 61131-3 programming language. It is independent of individual companies or products. Its specific tasks also include defining basic processes relevant to motion. The PLCopen organization consists of both users and manufacturers of automation components.
Parker Hannifin is an active member of the “Motion Control” task force. This represents a great advantage to users of Parker drive technology, since they are constantly able to profit directly from the latest developments in PLCopen.

Parker is a member of the "CoDeSys Automation Alliance"
What do these functions provide?

**Analysis and optimization of the mechanic system**

| Transmission behavior of the mechanic system | • Simple measurement of the mechanic dynamic behavior, therefore:
| | • Possibilities to improve the mechanic construction can be spotted.
| | • Increased stiffness and precision of the entire system.
| | (improved mechanic system = improved controller performance)
| Modal analysis | • Vibration analysis of the mechanic construction by specification of a sinusoidal motor force with a defined frequency.
| | • It is often possible to work without additional excitation by electrodynamic shakers or pulse hammers.

**Analysis and optimization of the control**

| Transmission behavior of the mechanic system | • Better and faster controller optimization due to the knowledge of the transmission behavior of the control path.
| | • Specific suppression of disturbances at the mechanic resonance points with the aid of notch or low-pass filters.
| Transmission behavior of the control | • Quality assessment of the control with respect to the response behavior:
| | • In the time range by step response
| | • In the frequency range by frequency response
| | • Optimization of the control by application of stability criteria from the control theory (e.g. Nyquist criterion or Hurwitz criterion)
| | • Quality assessment of the control with respect to the disturbance behavior:
| | • In the time range by the disturbance current - step response
| | • In the frequency range by measurement and analysis of the resilience - frequency response

---

1 Emulation of an external volatile change in the disturbance force.
2 The compliance frequency response states the size of the control deviation caused by a disturbance force in dependence of its frequency.
Automation Operation and Monitoring

Touchscreen HMI with Integrated Webserver - Interact Xpress™

Description

Distributed HMI in a durable and affordable package

XPR2 PowerStation line offers a hardware/software solution that simplifies and cost-reduces distributed HMI applications. Available with a 6”, 8”, 10”, 15” TFT panel mount touchscreen or new non-display system. XPR2 models are designed to optimize the performance, storage and connectivity features of Interact Xpress™ HMI software. This CE-based workstations features the latest embedded processor technology supporting fanless operation, CompactFlash® storage, USB, serial and 100Base-T Ethernet connectivity.

Take full advantage of the web for; HMI design, publishing, runtime and support

Interact Xpress fully leverages the wide availability of web browsing software to enable distributed HMI software, remote support and application sharing on the internet and IP networks. Interact Xpress HMI applications are developed, edited, published and run in an HMI that is a web server, allowing users and OEMs to easily publish upgrades and applications to any global location with an internet connection and a web browser.

Interact Xpress combines a rich, graphical runtime interface with HMI development tools that can be accessed from either the HMI panel or any PC running Internet Explorer®.

Features

- Fanless operation
- More than 40 communication drivers
- Complex animation capabilities
- Alarm logging
- Sending email on alarms
- Recipes
- Real time trending
- PDF documents viewing
- Multi language support
- Screen templates

Technical Characteristics - Overview

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<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
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<td>Display</td>
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<td>Storage options</td>
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<td>Operating system</td>
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<td>Ports</td>
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<td></td>
<td>2 USB</td>
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<td></td>
<td>RS232/422/485</td>
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<td>10/100 Base-T Ethernet</td>
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<td>Power supply</td>
<td>24 VDC</td>
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# Order Code

**Devices: Compax3**

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<th>Example:</th>
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<th>V2</th>
<th>4</th>
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<td>C3</td>
<td>S</td>
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<td>V2</td>
<td>F10</td>
<td>I10</td>
<td>T10</td>
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<th>2 Device type</th>
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<td>025 V2  2.5 A / 5 A; 230 VAC (single phase)</td>
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<td>063 V2  6.3 A /12.6 A; 230 VAC (single phase)</td>
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<td>100 V2  10 A /20A; 230 VAC (3 phase)</td>
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<tr>
<td>150 V2  15 A / 30 A; 230 VAC (3 phase)</td>
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<td>015 V4  1.5 A / 4.5 A; 400 VAC (3 phase)</td>
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<td>038 V4  3.8 A / 9 A; 400 VAC (3 phase)</td>
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<td>075 V4  7.5 A / 15.0 A; 400 VAC (3 phase)</td>
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<tr>
<td>150 V4  15.0 A /30.0 A; 400 VAC (3 phase)</td>
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<tr>
<td>300 V4  30.0 A /60.0 A; 400 VAC (3 phase)</td>
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</table>

| Compax3M                                        |   |   |   |   |   |   |   |   |   |
| 050 V4  50 A / 75 A; 400 VAC (3 phase)           |   |   |   |   |   |   |   |   |   |
| 090 V4  90 A /135 A; 400 VAC (3 phase)           |   |   |   |   |   |   |   |   |   |
| 125 V4  125 A /187.5 A; 400 VAC (3 phase)        |   |   |   |   |   |   |   |   |   |
| 155 V4  155 A /232.5 A; 400 VAC (3 phase)        |   |   |   |   |   |   |   |   |   |

| Compax3F                                        |   |   |   |   |   |   |   |   |   |
| 050 D6  5.0 A / 10.0 A; 400 VAC (3 phase)        |   |   |   |   |   |   |   |   |   |
| 100 D6  10 A / 20 A; 400 VAC (3 phase)           |   |   |   |   |   |   |   |   |   |
| 150 D6  15 A / 30 A; 400 VAC (3 phase)           |   |   |   |   |   |   |   |   |   |
| 300 D6  30 A / 60 A; 400 VAC (3 phase)           |   |   |   |   |   |   |   |   |   |

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<th>4 Feedback</th>
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<td>F12 Encoder, Sine/cosine with/without hall, EnDat</td>
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<tbody>
<tr>
<td>I10 Step/direction / analog input</td>
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<td>I11 Positioning via inputs/outputs</td>
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<td>I12 Positioning via I/Os / RS232 / RS485 / USB</td>
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<td>I20 PROFIBUS DP V0/V1/V2 (12 Mbaud)</td>
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<td>C20 C3 powerPLmC (Multi-axis control)</td>
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<th>6 Technology function</th>
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<td>T10 Servo controller (only I10)</td>
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<tr>
<td>T30 Motion control programmable in accordance with IEC 61131-3</td>
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<tr>
<td>M10 Extension by 12 digital I/Os &amp; HEDA Motionbus (not for T10, T11, C20)</td>
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<td>M11 HEDA Motionbus (not for T10, T11, C20)</td>
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<tr>
<td>M21 Analog current / voltage inputs (0...20 mA) and (-10...+10 V) (3 each)</td>
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<th>8 Optional safety technology for C3M</th>
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<tbody>
<tr>
<td>S1 Safe torque off (furnished with the device)</td>
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### Software dongle for SafePLC

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<th>Example:</th>
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</tr>
</thead>
<tbody>
<tr>
<td>SafePLC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| 1 SafePLC Dongle for programming the safety technology for the C3M option S3 |   |   |   |   |   |   |   |   |   |

---

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### Accessories

**Power module: PSUP**

<table>
<thead>
<tr>
<th>Example:</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSU P 10 D6 USB M00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 1 Device family

- **PSU** Mains Module

#### 2 Device type

- **P** Mains Module

#### 3 Nominal power; supply voltage

- **10 D6** 10 kW; 400 VAC (3 phase)
- **20 D6** 20 kW; 400 VAC (3 phase)
- **30 D6** 30 kW; 400 VAC (3 phase)

#### 4 Interface

- **USB** USB connection

#### 5 Options

- **M00** no additional supplement

(1) Operation of the PSUP30 only with line choke.

**We offer the following line chokes:**

- LCG-0055-0.45 mH (WxDxH: 180x140x157 mm; 10 kg)
- LCG-0055-0.45 mH-UL (with UL certification, WxDxH: 180x170x157 mm; 15 kg)

**Connection set for Compax3 and PSUP**

Mating plug connector (furnished with the device)

| 1 | ZBH02/02 |

#### 1 Accessories

- **ZBH02/01** for C3S0xxV2
- **ZBH02/02** for C3S0xxV4 / S150V4 / S1xxV2
- **ZBH02/03** for C3S300V4
- **ZBH02/04** for C3F00xD2
- **ZBH04/01** for C3M050D6, C3M100D6, C3M150D6
- **ZBH04/02** for C3M300D6
- **ZBH04/03** for PSUP10
- **ZBH04/04** for PSUP20/PSUP30

**Display and diagnostics:**

**Operator control module BDM01/01**

- Can be plugged in while in operation, supply via Compax3

**Operating Module**

| 1 | BDM01/01 |

#### 1 Accessories

- **BDM01/01** Operating module for Compax3S

---

### Motor Cable

**Example:**

- **MOK 55/02**

#### 1 Accessories

- **MOK** Motor cable

#### 2 Type

| 55/....(1) | 1.5 mm²; to 13.8 A |
| 54/....(1) | 1.5 mm²; up to 13.8 A cable chain compatible |
| 56/....(1) | 2.5 mm²; to 18.9 A cable chain compatible |
| 57/....(1) | 2.5 mm²; up to 18.9 A cable chain compatible |
| 60/....(1) | 1.5 mm²; to 13.8 A |
| 63/....(1) | 1.5 mm²; up to 13.8 A cable chain compatible |
| 59/....(1) | 2.5 mm²; to 18.9 A |
| 64/....(1) | 2.5 mm²; up to 18.9 A cable chain compatible |
| 61/....(1) | 6 mm²; to 32.3 A cable chain compatible |
| 62/....(1) | 10 mm²; to 47.3 A cable chain compatible |

**MOK55 and MOK54 are also possible for linear motors LXR406, LXR412.**

---

### Feedback cable

**Example:**

- **REK42/02**

#### 1 Accessories

- **for MH/SMH motors**
  - **REK42/....(1)** Resolver cable
  - **REK41/....(1)** Resolver cable cable chain compatible
- **GBK24/....(1)** SinCos© feedback cable (2) cable chain compatible
- **GBK38/....(1)** EnDat 2.1 feedback cable (2) cable chain compatible (C3S, H, M)
- **GBK23/....(1)** Encoder cable (2) cable chain compatible for linear motors
- **GBK33/....(1)** Feedback cable to LXR cable chain compatible
- **GBK40/....(1)** SSI, Start Stop (C3F)
- **GBK41/....(1)** EnDat 2.1 Feedback cable (C3F) cable chain compatible
- **GBK56/....(1)** EnDat 2.2 feedback cable (C3S, H, M) cable chain compatible
- **GBK57/....(1)** EnDat 2.2 Feedback cable (C3F) cable chain compatible

(1) - (4) see "Length code for cables" (page 32)
Order code for interface cables and connectors

<table>
<thead>
<tr>
<th>Length [m]</th>
<th>1.0</th>
<th>2.5</th>
<th>5.0</th>
<th>7.5</th>
<th>10.0</th>
<th>12.5</th>
<th>15.0</th>
<th>20.0</th>
<th>25.0</th>
<th>30.0</th>
<th>35.0</th>
<th>40.0</th>
<th>45.0</th>
<th>50.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order code</td>
<td>01</td>
<td>02</td>
<td>03</td>
<td>04</td>
<td>05</td>
<td>06</td>
<td>07</td>
<td>08</td>
<td>09</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
</tr>
</tbody>
</table>

1 Accessories
- SSK01/... RS232 (PC-Compax3)
- SSK33/... USB (PC-PSUP)
- SSK21/... Ref / analog - with flying leads (X11, X13 @C3F001D2)
- SSK22/... Digital I/Os with flying leads (X12 / X22)
- SSK23/... Ref / analog for I/O terminal block (X11)
- SSK24/... Digital I/Os for I/O terminal block (X12, X22)
- SSK25/... RS232 (PC-Pop)
- SSK27/... RS485 (C3-Pop for more than one C3H on request)
- SSK28/... RJ45 Cross over cable (C3 HEDA-HEDA, PC-C3 powerPLmC, C3M-C3M communication, PROFINET, EtherCAT, Ethernet Powerlink)
- SSK29/... Encoder coupling of 2 axes (X11-X11)
- SSK31/... Cable Modem Compax3 X10
- SSK32/20 Adapter cable for C3H to SSK01 (15 cm furnished with the device)
- VBK17/01 RS232 connection controller-programming interface (furnished with the device for C3H X10)
- BUS07/01 Bus terminal connector (1st. and last C3 in the HEDA bus/or multi-axis system)
- SSL01 ... PROFIBUS cable [a] not prefabricated
- BUS08/01 Profibus connector Plug with 2 cable inputs (1 arriving, 1 continuing PROFIBUS cable), as well as a switch for activating the terminal resistor
- SSL02 ... CAN Bus cable [b] not prefabricated
- BUS10/01 CAN bus connector Plug with 2 cable inputs (1x arriving, 1x continuing CANbus cable), as well as a switch for activating the terminal resistor


DeviceNet - A mating plug is included in the delivery. Additional information on DeviceNet wiring can be found under: www.odva.org

Length code for cables

[1] Length code 1 (Example: SSK01/09 = length 25 m)

<table>
<thead>
<tr>
<th>Length [m]</th>
<th>0.17</th>
<th>0.25</th>
<th>0.5</th>
<th>1.0</th>
<th>3.0</th>
<th>5.0</th>
<th>10.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order code</td>
<td>23</td>
<td>20</td>
<td>21</td>
<td>01</td>
<td>22</td>
<td>03</td>
<td>05</td>
</tr>
</tbody>
</table>

[1] Color according to DESINA
[2] with motor connector
[3] with cable eye for motor terminal box

Parker I/O System - PIO

<table>
<thead>
<tr>
<th>Example</th>
<th>1</th>
<th>2</th>
<th>337</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series</td>
<td>PIO</td>
<td>Parker I/O system</td>
<td></td>
</tr>
<tr>
<td>2 Fieldbus coupler</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>337 CANopen coupler</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>347 CANopen coupler ECO</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Bus terminals

Digital inputs
- 400 2DI 24 VDC 3.0 ms
- 402 4DI 24 VDC 3.0 ms
- 430 8DI 24 VDC 3.0 ms

Analog inputs
- 456 2AI ±10 VDC differential input
- 468 4AI 0-10 VDC S.E.
- 480 2AI 0-20 mA differential input

Digital outputs
- 501 2DO 24 VDC 0.5 A
- 504 4DO 24 VDC 0.5 A
- 530 8DO 24 VDC 0.5 A

Analog outputs
- 550 2AO 0-10 VDC
- 552 2AO 0-20 mA
- 556 2AO ±10 VDC

System terminals
- 600 Bus terminal (required as terminal for each fieldbus node)
- 602 Power supply terminal 24 VDC

Accessories

PIO quick designation system
(designation indicators for manual labeling)
- 501 WEISS white
- 501 GELB yellow
- 501 ROT red
- 501 BLAU blue
- 501 GRAU grey
- 501 ORANGE orange
- 501 HELLGRIIN light green


DeviceNet - A mating plug is included in the delivery. Additional information on DeviceNet wiring can be found under: www.odva.org
### Braking resistors

<table>
<thead>
<tr>
<th>Example:</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRM 05/01</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**1 Accessories**
- BRM Braking resistor

<table>
<thead>
<tr>
<th>Type</th>
<th>05/01</th>
<th>05/02</th>
<th>08/01</th>
<th>10/01</th>
<th>04/01</th>
<th>04/02</th>
<th>04/03</th>
<th>09/01</th>
<th>11/01</th>
<th>13/01</th>
<th>14/01</th>
<th>12/01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>56 Ω / 0.18 kW&lt;sub&gt;cont&lt;/sub&gt; (for C3S063V2, C3S075V4)</td>
<td>56 Ω / 0.57 kW&lt;sub&gt;cont&lt;/sub&gt; (for C3S075V4)</td>
<td>100 Ω / 0.60 kW&lt;sub&gt;cont&lt;/sub&gt; (for C3S025V2, C3S038V4)</td>
<td>47 Ω / 0.57 kW&lt;sub&gt;cont&lt;/sub&gt; (for C3S150V4)</td>
<td>15 Ω / 0.57 kW&lt;sub&gt;cont&lt;/sub&gt; (for C3S150V2, C3S300V4)</td>
<td>15 Ω / 0.74 kW&lt;sub&gt;cont&lt;/sub&gt; (for C3S150V2, C3S300V4)</td>
<td>15 Ω / 1.5 kW&lt;sub&gt;cont&lt;/sub&gt; (for C3S300V4)</td>
<td>22 Ω / 0.45 kW&lt;sub&gt;cont&lt;/sub&gt; (for C3S100V2)</td>
<td>27 Ω / 3.5 kW&lt;sub&gt;cont&lt;/sub&gt; (for C3H0xxV4)</td>
<td>30 Ω / 0.5 kW&lt;sub&gt;cont&lt;/sub&gt; (for PSUP10D6, PSUP20D6 (2x30Ω parallel))</td>
<td>15 Ω / 0.5 kW&lt;sub&gt;cont&lt;/sub&gt; (for PSUP10D6 2 x 15 Ω in series for PSUP20, PSUP30)</td>
<td>18 Ω / 4.5 kW&lt;sub&gt;cont&lt;/sub&gt; (for C3H1xxV4, PSUP30)</td>
</tr>
</tbody>
</table>

- For radio interference suppression and compliance with the emission limit values for CE conform operation.

**Example:**
- NFI 01/01

**1 Accessories**
- NFI Mains filter

<table>
<thead>
<tr>
<th>Type</th>
<th>01/01</th>
<th>01/02</th>
<th>01/03</th>
<th>02/01</th>
<th>02/02</th>
<th>02/03</th>
<th>03/01</th>
<th>03/02</th>
<th>03/03</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>for C3S025V2 or S063V2</td>
<td>for C3S0xxV4, S150V4 or S1xxV2</td>
<td>for C3S300V4</td>
<td>for C3H050V4</td>
<td>for C3H090V4</td>
<td>for C3H1xxV4</td>
<td>for PSUP10 Reference axis combination 3x480 V 25 A 6x10 m motor cable length</td>
<td>for PSUP10 Reference axis combination 3x480 V 25 A 6x50 m motor cable length</td>
<td>for PSUP20, PSUP30 Reference axis combination 3x480 V 50 A 6x50 m motor cable length</td>
</tr>
</tbody>
</table>

### Motor output choke

**Example:**
- MDR 01/04

**1 Accessories**
- MDR Motor output choke

**2 Type**
- 01/01 up to 16 A rated motor current
- 01/02 up to 30 A rated motor current
- 01/04 up to 6.3 A rated motor current

### Capacitor module

**Example:**
- ModulC4

### Terminal block

**Example:**
- EAM 06/01

**1 Accessories**
- EAM Terminal block

**2 Type**
- 06/01 I/Os without luminous indicator (for X11, X12, X22)
- 06/02 I/Os with luminous indicator (for X12, X22)
With our Devices you get:

The requested

**Compax3 Device**

with the most important information in printed form

- Installation manual in German / English, French and
- Startup guide in German / English

**Compax3 - DVD**

with the latest software tools:

- C3 ServoManager (Software tool) for the configuration, setup and optimization...
- Parker Integrated Engineering Tool (Software tool) for the project management of several Parker Motion Control products.
- Software tool for supporting the software installation
- Bus Files
- C3M_USB_driver
- CamDesigner
- CoDeSys
- Parker SafePLC

- CAD Files
- Catalogs
- Detailed manuals (PDF) and help files (CHM))
  - an individual manual and help file version for each Compax3 technology function
  - in German, English and French
  - with over 80 manuals and help files containing more than 20,000 pages
  - Help files feature to some extent explanatory videos

Compax3 on the Internet:

- EPLAN
- System files
- Firmware
- All software tools for Compax3

www.parker.com/eme/c3

Training Portfolio:

**Compax3 Trainings**

Our portfolio ranges from an introduction into the Compax3 device technology to Compax3 powerPLmC control technology.

- Training seminars are held in German and English
- One-day or several-day seminars
- All training material included
- All training seminars can also be held at your premises, if desired

Additional information on: www.parker.com/eme/seminar
At Parker, we're guided by a relentless drive to help our customers become more productive and achieve higher levels of profitability by engineering the best systems for their requirements. It means looking at customer applications from many angles to find new ways to create value. Whatever the motion and control technology need, Parker has the experience, breadth of product and global reach to consistently deliver. No company knows more about motion and control technology than Parker. For further info call 0800 27 27 5374

**Aerospace**

**Key Markets**
- Aftermarket services
- Commercial transports
- Engines
- General & business aviation
- Helicopters
- Launch vehicles
- Military aircraft
- Missiles
- Power generation
- Regional transports
- Unmanned aerial vehicles

**Key Products**
- Control systems & actuators
- Engine systems & components
- Fluid conveyance systems & components
- Fluid metering, delivery & ablation devices
- Fuel systems & components
- Fuel tank inflight systems
- Hydraulic systems & components
- Thermal management
- Wheels & brakes

**Climate Control**

**Key Markets**
- Agriculture
- Air conditioning
- Construction/Machinery
- Food & beverage
- Industrial machinery
- Life sciences
- Oil & gas
- Precision cooling
- Process
- Refrigeration
- Transportation

**Key Products**
- Accumulators
- Advanced actuators
- CO₂ controls
- Electronic controllers
- Filter elements
- Hand shut-off valves
- Heat exchangers
- Hose & fittings
- Pressure regulating valves
- Refrigerant distributors
- Safety relief valves
- Smart pumps
- Solenoid valves
- Thermostatic expansion valves

**Electromechanical**

**Key Markets**
- Aerospace
- Factory automation
- Life science & medical
- Machine tools
- Packaging machinery
- Paper machinery
- Plastic machinery & converting
- Primary metals
- Semiconductor & electronics
- Textiles
- Wire & cable

**Key Products**
- AC/DC drives & systems
- Electric actuators, gantry robots & lifts
- Electrohydraulic actuation systems
- Electromechanical actuation systems
- Human machine interfaces
- Linear motors
- Stepper motors, servo motors, drives & controls
- Structural extrusions

**Process Control**

**Key Markets**
- Alternative fuels
- Biopharmaceuticals
- Chemical & refining
- Food & beverage
- Marine & shipbuilding
- Medical & dental
- Microelectronics
- Nuclear Power
- Offshore oil exploration
- Oil & gas
- Pharmaceuticals
- Power generation
- Pulp & paper
- Steel
- Water/wastewater

**Key Products**
- Analytical Instruments
- Analytical sample conditioning products & systems
- Chemical injection fittings & valves
- Fluorescence chemical delivery fittings, valves & pumps
- High purity gas delivery fittings, valves, regulators & digital flow controllers
- Industrial mass flow meters/ controllers
- Permanent no-weld tubing
- Precision industrial regulators & flow controllers
- Process control double block & bleed
- Process control fittings, valves, regulators & manifolds

**Fluid & Gas Handling**

**Key Markets**
- Aerial lift
- Agriculture
- Bulk chemical handling
- Construction machinery
- Food & beverage
- Fuel & gas delivery
- Industrial machinery
- Life sciences
- Marine
- Mining
- Mobile
- Oil & gas
- Renewable energy
- Transportation

**Key Products**
- Check valves
- Connectors for low pressure fluid conveyance
- Deep sea umbilicals
- Diagnostic equipment
- Hose couplings
- Industrial hose
- Mooring systems & power cables
- PTFE hose & tubing
- Quick couplings
- Rubber & thermoplastic hose
- Tubing fittings & adapters
- Tubing & plastic fittings

**Hydraulics**

**Key Markets**
- Aerial lift
- Agriculture
- Alternative energy
- Construction machinery
- Factory automation
- Industrial machinery
- Machine tools
- Marine
- Material handling
- Mining
- Oil & gas
- Power generation
- Refuse vehicles
- Renewable energy
- Truck hydraulics
- Turf equipment

**Key Products**
- Accumulators
- Cartridge valves
- Electrohydraulic actuators
- Human machine interfaces
- Hosed drives
- Hydraulic cylinders
- Hydraulic motors & pumps
- Hydraulic systems
- Hydraulic valves & controls
- Hydrostatic steering
- Integrated hydraulic circuits
- Power take-offs
- Power units
- Rotary actuators
- Sensors

**Pneumatics**

**Key Markets**
- Aerospace
- Convoy & material handling
- Factory automation
- Life science & medical
- Machine tools
- Packaging machinery
- Transportation & automotive

**Key Products**
- Air preparation
- Brass fittings & valves
- Manifolds
- Pneumatic accessories
- Pneumatic actuators & grippers
- Pneumatic valves & controls
- Quick disconnects
- Rotary actuators
- Rubber & thermoplastic hose & couplings
- Structural extrusions
- Thermoplastic tubing & fittings
- Vacuum generators, cups & sensors

**Process Control**

**Key Markets**
- Alternative fuels
- Biopharmaceuticals
- Chemical & refining
- Food & beverage
- Marine & shipbuilding
- Medical & dental
- Microelectronics
- Nuclear Power
- Offshore oil exploration
- Oil & gas
- Pharmaceuticals
- Power generation
- Pulp & paper
- Steel
- Water/wastewater

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- Analytical Instruments
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- Permanent no-weld tubing
- Precision industrial regulators & flow controllers
- Process control double block & bleed
- Process control fittings, valves, regulators & manifolds

**Filtration**

**Key Markets**
- Aerospace
- Chemical processing
- Consumer
- Fluid power
- General industrial
- Information technology
- Life sciences
- Microelectronics
- Military
- Oil & gas
- Power generation
- Renewable energy
- Telecommunications
- Transportation

**Key Products**
- Analytical gas generators
- Compressed air filters & dryers
- Engine oil, coolant, fuel & air filtration systems
- Fluid condition monitoring systems
- Hydraulic & lubrication filters
- Hydrogen, nitrogen & zero air generators
- Instrumentation filters
- Membrane & Ro filters
- Microfiltration
- Sterile air filters
- Water desalination & purification filters & systems

**Sealing & Shielding**

**Key Markets**
- Aerospace
- Chemical processing
- Consumer
- Fluid power
- General industrial
- Information technology
- Life sciences
- Microelectronics
- Military
- Oil & gas
- Power generation
- Renewable energy
- Telecommunications
- Transportation

**Key Products**
- Dynamic seals
- Elastomeric o-rings
- Electro-mechanical instrument design & assembly
- EMI shielding
- Extruded & precision cut, fabricated elastomeric seals
- High temperature metal seals
- Homogenized & inserted elastomeric shapes
- Medical device fabrication & assembly
- Metal & plastic retained composite seals
- Shaped optical windows
- Silicone tubing & extrusions
- Thermal management
- Vibration damping