

# Olivetti OH 5400, OH 5480 & OH 5490 Series

## MANAGEMENT SUMMARY

In June 1982, Olivetti Computers S.p.A. was merged into its parent company ING. C. OLIVETTI & Co. S.p.A. Since then, ING. C. OLIVETTI & Co. S.p.A. has been marketing the OH 5400 Series, the OH 5480 Series, and the OH 5490 Series, a group of IBM plug-compatible processors that are manufactured by Hitachi. In September 1983, the line of products marketed by Olivetti was expanded to include plug-compatible peripherals such as the OH 4000 Disk Subsystem which is also manufactured by Hitachi.

The range of compatibility of the OH 5440, OH 5450, and the OH 5450S falls between the IBM 4341 and IBM 3083 processors. The OH 5480/4, 5480/6, and 5480/8 are compatible with the IBM 3083. The OH 5490/7 and OH 5490/9 Uniprocessors offer compatibility from the IBM 3083 to the IBM 3081G. In the multiprocessor configuration, the OH 5490/11 is compatible with the IBM 3081 and IBM 3084.

The OH 5400 Series, which consists of three models: the OH 5440, OH 5450, and OH 5450S, can accommodate medium users in the areas of business, data base/data communications, interactive and scientific applications. Each of the three models can be upgraded on-site without involving substitutions of equipment or disruption of service to users.

Through the use of high speed VLSI circuits with densities of up to 1500 gates per chip, compact systems have been created which require less power and less space. For example, configurations of the OH 5440 (up to 8 megabytes) require only .96 m<sup>2</sup> of floor space. ➤

Olivetti's OH 5400, 5480, and 5490 Series are plug-compatible systems that are manufactured by Hitachi.

**MODELS:** OH 5400 Series—5440, 5450, and 5450S; OH 5480 Series—5480/4, 5480/6, and 5480/8; OH 5490 Series—OH 5490/7, 5490/9, and 5490/11.

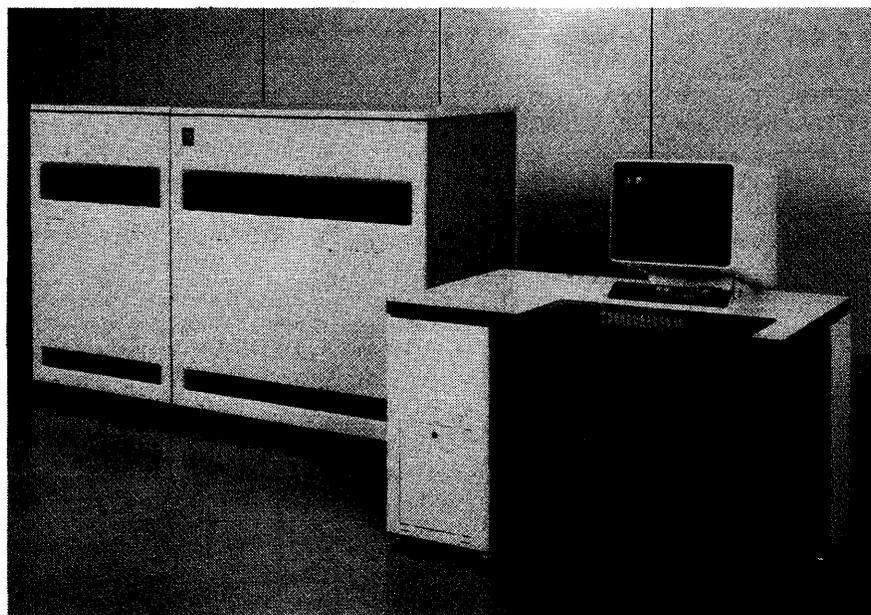
**CONFIGURATIONS:** OH 5400 Series—2M to 16M bytes of main memory, attachment of up to 8 channels; OH 5480 Series—8M to 32M bytes of main memory, attachment of up to 8 channels; OH 5490 Series—8M to 32M bytes of main memory, attachment of up to 16 channels.

**COMPETITION:** OH 5400 Series—IBM processors between the 4341 and 3083; OH 5480 Series—IBM 3083; OH 5490/7 and OH 5490/9 (uniprocessors)—IBM processors from the 3083 to 3081G; the OH 5490/11 (multiprocessor)—IBM 3081 and 3084.

## CHARACTERISTICS

**SUPPLIER:** ING. Co. OLIVETTI & Co. S.p.A., Direzione Olivetti Computers, Via Meravigli, 12, 20123 Milano, Italy. Telephone (2) 88361.

**MANUFACTURER:** Hitachi, Ltd., 5-1, Marunouchi, 1-chome, Chiyoda-ku, Tokyo 100, Japan. ➤



*The OH 5450 system is oriented toward medium users in real-time, business and scientific applications.*

## Olivetti OH 5400, OH 5480 & OH 5490 Series

➤ The three CPUs of the OH 5400 Series are fully compatible and can operate under the following System Control Programs: DOS/VSE, MVS/SP, and VM/SP. In addition, a wide variety of microcoded features and assists have been designed to enhance the performance of the System Control Programs. The modular design of the OH 5400 Series enables users to choose a wide selection of memory and channel configurations within each model.

The configurations for the OH 5400 Series are as follows: the OH 5440—minimum of 2 megabytes up to a maximum of 16 megabytes of memory and the attachment of from 5 to 8 channels; the OH 5450 and OH 5450S—minimum of 4 megabytes up to a maximum of 16 megabytes and the attachment of from 5 to 8 channels.

The OH 5480 Series consists of the Model 4, Model 6, and Model 8 processors. The models differ from one another in the areas of buffer (cache) size, pipeline control, and performance. The OH 5480 is a high-performance, general-purpose processor designed for large-scale on-line processing for business and scientific applications. According to Olivetti, high performance and the improvement of reliability and maintenance have been achieved through advanced logic design and newly-developed hardware technology. Future needs of users can be accommodated through the expandability of the system.

Configurations for the OH 5480 are as follows: Model 4—maximum Main Storage is 16 megabytes and the maximum number of channels that can be attached is 16; Models 6 and 8—maximum Main Storage is 32 megabytes and the maximum number of channels that can be attached is 16. Both the Models 6 and 8 are equipped with a buffer size of 64KB and the Model 4 is equipped with a buffer size of 32KB.

The OH 5490 Series, which consists of Models 7, 9, and 11, is a high-performance, general-purpose processor that is appropriate for large-scale, on-line processing for business and scientific applications. The OH 5490 is a high-end successor to the OH 5560 which is no longer being marketed. Allowances have been made in the processor and through optional features for expansion of the system to meet future needs. Models 7, 9, and 11 provide Main Storage capacities of 8, 16, 24, and 32 megabytes. A total of 8 channels can be attached to each of the models in the 5490 Series.

High-density, high-speed LSIs used extensively throughout the major portions of the processor can accommodate a maximum of 550 gates (400 circuits) per chip. The Main Storage in a uniprocessor configuration has an 8-way interleaved structure. In an Attached Processor/Multiprocessor arrangement, Main Storage structure is 16-way interleaved.

### COMPETITIVE POSITION

The OH 5440, OH 5450, and OH 5450S compete with IBM processors within the range of the 4341 and 3083, as well as with comparable models from other plug-compatible vendors.

➤ **MODELS:** OH 5400 Series—OH 5440, OH 5450, and OH 5450S, all of which are plug-compatible with IBM processors between the IBM 4341 and 3083; OH 5480 Series—Models 4, 6, and 8, all of which are compatible with the IBM 3083; OH 5490 Series—Models 7, 9, and 11, of which the Models 7 and 9 in a uniprocessor configuration are compatible with IBM's processors from the 3083 to 3081G. The Model 11 in a multiple processor configuration is compatible with the IBM 3081 and 3084.

OH 5440:

### CENTRAL PROCESSING UNIT

The three sub-elements incorporated into the Central Processing Unit are the Basic Processing Unit, Storage Control Unit, and the Service Unit.

The Basic Processing Unit, the system's Central Processor, provides the functions necessary for high-speed processing and for the system's controls. It is composed of the following major elements: Instruction Unit, Execution Unit, and Reloadable Control Storage. The Instruction Unit handles instruction fetching and decoding for the Execution Unit which carries out instructions at the speed of the processor's cycle time which is 60 nanoseconds for the OH 5440 and 50 nanoseconds for the OH 5450 and OH 5450S.

The microcoded control programs essential to the control of systems' operation are located in Reloadable Control Storage (RCS). The RCS feature is also used during maintenance and diagnostic execution for holding designated micro-diagnostic programs.

The High Speed Arithmetic feature heightens the performance of the Basic Processing Unit during the execution of scientific application programs. The Storage Control Unit regulates the access of data to and from main storage for the BPU and the High Speed Buffer. The required circuitry for interfacing and controlling access to and from the High Speed Buffer is also contained in the Storage Control Unit.

### MAIN STORAGE

The Main Storage (MS) consists of high-speed monolithic 64KB N-MOS chips with a read/write cycle time of 500 or 600 nanoseconds. Data access is improved through the use of 2-way interleaving techniques and an access width of 8 bytes. System Control Programs with virtual memory capabilities of up to 16 megabytes can be supported by the OH 5400 Series. The management of virtual addresses is implemented either by the Dynamic Address Translation feature or by the microcode residing within the Reloadable Control Storage in ECPS:VSE mode.

### HIGH SPEED BUFFER

The High Speed Buffer consists of high-speed bipolar memory elements, an address array, and a replacement array. Each of the three models in the OH 5400 Series is equipped with a high-speed buffer capacity of 64KB.

### INPUT/OUTPUT CHANNELS

Two types of input/output channels are provided. The first, the Byte Multiplexer Channel, exists for the most part for the attachment of slow speed peripheral devices and can operate at a speed up to 100KB per second. The second type of channel, the Block Multiplexer Channel, is designed for the attachment of fast I/O peripherals and can operate at a speed of up to 3 megabytes per second.

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- The OH 5480/4, OH 5480/6, and OH 5480/8 compete with the IBM 3083, as well as with comparable models from other plug-compatible vendors.

The OH 5490/7 and the OH 5490/9 in a uniprocessor configuration compete with IBM processors in the range of the IBM 3083 to the IBM 3081G. In a multiple processor configuration, the OH 5490/11 competes with the IBM 3081 and 3084.

Each of these models also competes with comparable offerings from other plug-compatible vendors. □

- The basic channel configuration of one Byte Multiplexer Channel and four Block Multiplexer channels can be extended up to two Byte Multiplexer Channels and six Block Multiplexer Channels. A high throughput rate is effected by the system's aggregate data rate of 13 megabytes per second (OH 5440) and 16 megabytes per second (OH 5450 and OH 5450S).

Peripheral devices operating in accordance with IBM channel specifications can be connected to the channels of the OH 5400 Series. IBM disk units such as the 3370, 3375, and 3380 can be accommodated by the input/output channels.

### SERVICE UNIT

Located within the CPU of the OH 5400 Series, the Service Unit consists of an independent microprocessor capable of interfacing with the Basic Processing Unit and controlling a peripheral subsystem set which consists of a video and keyboard, two floppy disks, and an optional printer. To avoid interfering with the system's operation during complex functions, the Service Unit is equipped with dedicated Reloadable Control Storage. The console service processor performs error detection and error log-out functions. For the convenience of operators and maintenance personnel, error codes are displayed on the console.

OH 5480:

### CENTRAL PROCESSING UNIT

The Central Processing Unit includes the Main Storage, a Power Distribution Unit, and the Basic Processing Unit (BPU). The BPU consists of the Execution Unit, Instruction Unit, Storage Control Unit, Service Unit, and one Input/Output Processor which includes a total of 8 channels (up to 2 Byte Multiplexer Channels and up to 8 Block Multiplexer Channels).

### MAIN STORAGE

For the purpose of processing requests from multiple units, the Storage Control Unit (SCU) contains data buffer registers, request and address stacks, and priority logic which dynamically manages priority among the requests. Additional functions offered by the SCU include: high-speed data transfer from main storage into buffer storage; storage protection key and compare logic; dedicated address array; floating address facility for rearranging main storage addressing in units of 4 megabytes. The Address Translation Unit converts the logical address of a request from the Instruction Unit or the Execution Unit to a real address. Subsequently, the real address is sent to the Storage Control Unit where it is converted by the floating address facility to

the physical address of the main storage module. A Storage Protection facility protects the contents of main storage from erroneous access attempts by hardware or software.

### BUFFER STORAGE

Conceptually, Buffer Storage is a copy of main storage and increases performance by raising the access speed of main storage. The user does not become involved with the similarity of the contents between buffer storage and main storage because this coincidence of contents is handled by the hardware. The capacity of Buffer Storage is 64KB or 32KB. The 64KB buffer storage is divided into 1024 blocks, arranged in 64 columns and 16 rows when the page size is 4KB, or in 32 columns and 32 rows when the page size is 2KB. The 32KB buffer storage is divided into 512 blocks, arranged in 64 columns and 8 rows when the page size is 4KB or in 32 columns and 16 rows when the page size is 2KB.

### INPUT/OUTPUT CHANNELS

In the OH 5480 Series, communication between central storage and input/output devices is regulated by the Input/Output Processor (IOPX) which consists of a CH-common control and up to 8 channel I/O-interface controls (CH). The CH-common control is divided into two sub-control units: Channel Construction Control and Channel Data Control. Byte-interleaving, direct-current block interleaving, and data streaming modes are supported by a CH. The maximum number of channels per Input/Output Processor is 8. The IOPX can support up to 8 1-Block Multiplexer Channels and up to two 2-Byte Multiplexer Channels. In a Block Multiplexer Channel data streaming mode, the maximum data transfer rate is 3.0 MB.

Any channel can be configured as either a block-multiplexer channel or a byte-multiplexer channel. Up to two Input/Output processors can be configured in a single system. Both Byte and Block Multiplexer Channels are designed with 256 subchannels which support I/O operations. Each subchannel has a one-unit control word assigned to it, and the unit control words are stored into Subchannel Storage.

### SERVICE UNIT

A request from the Execution Unit or from the Service Processor, with which it interfaces, activates the Service Unit. Incorporating a fault location capability, the Service Unit automatically displays on the console a reference code which indicates the nature and area of the failure. The Service Processor contains a microprogram which controls maintenance and diagnostic functions. The Stage Tracer feature traces and records the internal state of the Basic Processing Unit for use in fault analysis. Along with one or two console displays, the Service Processor provides system control functions and acts as the human interface to the processor complex.

OH 5490:

### CENTRAL PROCESSING UNIT

OH 5490-7:

The Central Processing Unit consists of the Main Storage, two Power Distribution Units, the Basic Processing Unit (which also contains the general arithmetic unit, floating point arithmetic unit, instruction unit, storage control unit, IOP adapter, and service unit) and the first Input/Output Processor which includes a total of 8 channels. The 5490-7 can be field-upgraded to a Model 9 Central Processing Unit by installing a Model 7-to-Model 9 BPU Upgrade. ➤

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### ► OH 5490-9:

In the OH 5490-9, the Central Processing Unit includes the Main Storage, two Power Distribution Units, the Basic Processing Unit (which also contains the general arithmetic unit, floating point arithmetic unit, instruction unit, storage control unit, IOP adapter, and service unit), and the first Input/Output Processor which includes a total of 8 channels. The OH 5490-9 can be field-upgraded to an OH 5490-11 Central Processing Unit via a Model 9-to-Model 11 BPU Upgrade.

#### OH 5490-9 Attached Processor:

This unit differs from the OH 5490 in that it is deprived of the Main Storage, IOP adapter and the first IOP. The OH 5490-9 is necessary for the configuration of a multiprocessor complex.

#### OH 5490-11

The Central Processing Unit of the OH 5490-11 consists of Main Storage, (up to 32 megabytes), two power Distribution Units, the Basic Processing Unit (which is also composed of general arithmetic unit, floating point arithmetic unit, instruction unit, storage control unit, IOP adapter, and service unit) and the first Input/Output Processor which includes a total of 8 channels.

#### OH 5490-11 Attached Processor

This unit differs from the OH 5490-11 in that it is deprived of the Main Storage, IOP adapter and the first IOP. The OH 5490-11 Attached Processor is necessary for the configuration of a multiprocessor complex.

#### Attached Processor Complex (applicable to 5490-9 and 5490-11)

The OH 5490 Attached Processor Complex/Multiprocessor Complex offers greater internal performance than the single processor because each processor, the CPU and the Attached Processor can concurrently execute its own instruction stream. In the Attached Processor/Multiprocessor environment, all addresses of Main Storage are dynamically shared and accessed under a single operating system by both processors. IOPs are also shared dynamically under program control in this type of configuration. If a hardware failure within the CPU should occur, the Attached Processor can assume the management of the IOPs to return to system operation.

### MAIN STORAGE

Main Storage, consisting of high-speed MOS memory chips, offers capacities ranging from 8 megabytes to 32 megabytes. Within each module are 8 banks, each with a capacity of 1 megabyte and a data depth of 8 bytes. Each bank can be accessed independently of one another.

In Main Storage of two or more modules, the banks of the same bank number in all modules are combined to form an 8-bank organization. In a uniprocessor configuration, Main Storage makes use of 8-way interleaving, allowing 8 banks to be accessed independently of one another.

In an attached processor/multiprocessor configuration, Main Storage makes use of 16-way interleaving, allowing 16 banks to be accessed independently of one another. In the 16-way interleaving arrangement, two 8 megabyte modules are set in a parallel manner to form a 16-bank organization, allowing memory capacities to range from 16 megabytes to 32 megabytes in increments of 16 megabytes.

The Storage Control Unit provides high-speed data transfer from Main Storage into Buffer Storage. This unit also offers the following functions: storage protection key and compare logic; dedicated address array; and floating point address facility.

### BUFFER STORAGE

The CPU provides Buffer Storage, which is basically a copy of Main Storage, to increase performance by accelerating the access speed of Main Storage. The similarities between the contents of Buffer Storage and Main Storage are handled by the hardware. Buffer Storage capacities can range from 54KB to 256KB.

The Address Array function of Buffer Storage enables the block address of each block of Buffer Storage to be stored in its corresponding entry of the address array. The Replacement Array function in a 64KB arrangement uses two-level hierarchy control to divide 8 blocks within the column into 4 blocks. This function also registers the least recently used block within each group as well as within the 4 groups. In a 256KB buffer storage arrangement, the Replacement Array uses three-level hierarchy control to divide 32 blocks within the column into 4 groups. It also registers the least-recently used block within each group as well as within the four 2nd level groups and the least recently used group within the four 1st level groups.

### INPUT/OUTPUT CHANNELS

The first Input/Output Processor is a standard feature in the OH 5490 CPU. Up to three more IOPs can be attached to each Model 5490-11. Up to two more IOPs can be attached to each model of the OH 5490-7 and OH 5490-9 Central Processing Units.

The first IOP accommodates channel addresses 0 through 7; the second IOP accommodates channel addresses 8 through 15; the third IOP accommodates channel addresses 16 through 23 or 24 through 31; the fourth IOP accommodates channel addresses 16 through 23. Six or seven Block Multiplexers are included in the CPU of an OH 5490. The following are standard features of the block multiplexers: Fast Release, Clear I/O, Channel Indirect Data Addressing, Command Retry, Limited Channel Logout, I/O Extended Logout, and Clear Channel Instruction.

A Byte Multiplexer is capable of concurrently operating a number of byte multiplexing mode input/output devices and allowing the attachment of eight control units. One or two Byte Multiplexers are included in the CPUs of the OH 5490. The following are standard features of the Byte Multiplexers: Clear I/O, Channel Indirect Data Addressing, Limited Channel Logout, I/O Extended Logout, and Clear Channel Instruction.

The Extended Channels (ECH) feature provides an additional group of 4 channels (0-1 Byte Multiplexer and 3-4 Block Multiplexers) for the second, third, or fourth IOP.

### SERVICE UNIT

Serving as the interface with the Console Service Processor, the Service Unit undertakes diagnostic maintenance operations. Activated by a request from the General Arithmetic Unit or the Console Service Processor, the Service Unit performs maintenance/diagnostics under the control of the Console Service Processor's microprogram. The microinstructions in the General Arithmetic Unit initiate the microprogram in the Service Unit's control storage for the performance of diagnostic operations such as scan in, scan out, and clock advance control.

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► The Stage Tracer, a part of the Service Unit, traces and records the internal state of the Basic Processing Unit for use in fault analysis. The initial set-up and the read-out of trace data can be effected from the Console Service Processor. The Stage Tracer accumulates the information required for the maintenance of the Basic Processing Unit hardware

and information necessary for trouble-shooting in the event of a system-related failure.

Features exist for the modification of the standard United States keyboard on the Console Service Processor to British, French, German, Italian, Belgian, or Swedish layouts. ■

### EQUIPMENT PRICES

	Purchase Price (in thou- sand Italian lire)	2-Year Rental (in thou- sand Italian lire)	4-Year Rental (in thou- sand Italian lire)	Annual Maint. (in thou- sand Italian lire)
<b>OH 5400 SERIES</b>				
CENTRAL UNITS				
OH 5430 2MB, 5CH, CONS	394.575	14.939	14.042	1.715.000
OH 5440 2MB, 5CH, CONS	448.382	16.977	15.958	1.865.000
OH 5450 4MB, 5CH, CONS	582.752	22.328	20.993	2.273.000
OH5450S 4MB, 5CH, CONS	659.987	25.903	24.349	2.574.000
OPTIONAL FEATURES				
2MB Memo X OH5440/5430	26.328	981	922	52.000
4MB OF Memory	52.657	1.962	1.844	104.000
Add'l frame 1 X OH5440	19.778	698	655	—
1 channel byte MPX	6.486	267	251	5.000
2 channels block MPX	14.580	561	522	10.000
CTCA	22.987	763	718	42.000
Direct Control Feature	5.555	178	167	5.000
24 PCI position add'l	3.000	107	100	5.000
UPGRADE KITS				
OH 5430 to OH 5440	53.807	2.038	1.916	150.000
OH 5440 to OH 5450	108.042	3.672	3.458	356.000
OH 5450 to OH 5450-S	77.235	3.575	3.355	301.000
<b>OH 5480 SERIES</b>				
CENTRAL UNITS				
OH 5480 MOD 4 8MB, 8CH, 110P, CONS	1.753.083	71.040	65.160	6.600.000
OH 5480 MOD 6 8MB, 8CH, 110P, CONS	2.150.118	90.003	82.571	7.325.000
OH 5480 MOD 8 8MB, 8CH, 110P, CONS	2.600.344	108.232	99.241	8.109.000
OPTIONAL FEATURES				
4MB of Memory	99.301	3.608	3.311	175.000
2nd 10P + 4 add'l CH's	113.064	4.441	4.074	230.000
4 add'l CH's on 2nd 10P	40.312	1.582	1.451	100.000
HSA	190.053	6.842	6.276	250.000
CTCA	19.243	622	571	85.000
Alternative console	32.125	1.218	1.117	70.000
Prerequisite over 16MB	83.333	3.165	2.903	150.000
24 PCI positions add'l	5.848	210	192	30.000
Console desk	1.111	—	—	—
UPGRADE KITS				
OH 5480/4 to OH 5480/6	397.035	18.963	17.411	725.000
OH 5480/6 to OH 5480/8	450.226	18.229	16.670	784.000
<b>OH 5490 SERIES</b>				
CENTRAL UNITS				
OH 5490 MOD 7 8MB, 8CH, 110P, CONS	2.493.074	96.144	90.856	7.980.000
OH 5490 MOD 9 8CH, 8MB, 110P, CONS	3.004.056	128.384	121.323	9.318.000
OH 5490 MOD 11 8MB, 8CH, 110P, CONS	3.711.346	149.382	141.165	10.157.000

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EQUIPMENT PRICES

	<b>Purchase Price (in thou- sand Italian lire)</b>	<b>2-Year Rental (in thou- sand Italian lire)</b>	<b>4-Year Rental (in thou- sand Italian lire)</b>	<b>Annual Maint. (in thou- sand Italian lire)</b>
<b>OPTIONAL FEATURES</b>				
8 MB of Memory	159.390	7.008	6.623	350.000
2nd 10P + 4 add'l CH's	105.600	4.623	4.440	230.000
4 add'l CH's on 2nd 10P	42.973	2.126	2.008	100.000
CTCA	21.265	622	571	94.000
1AP	229.234	8.832	8.346	630.000
MS extension gate	161.030	6.203	5.864	550.000
Corequisite CBLFUP3 X MSEG	8.125	353	338	23.000
Two-channel switch PRA	1.890 800	71 31	67 28	6.000 3.000
<b>UPGRADE KITS</b>				
OH 5490/7 to OH 5490/9	510.982	32.240	30.467	1.338.800
OH 5490/9 to OH 5490/11	707.290	20.998	19.842	839.000 ■