



RTOS Debugger for Nucleus PLUS

68k
ARM
XSCALE
C166
H8/300H
M-CORE
MIPS
PowerPC
SH4
TriCore
X86

- Improved support for the Nucleus PLUS debugger DBUG+
- Real time, non-intrusive display of Nucleus PLUS system resources
- Nucleus PLUS specific display of trace listing
- Statistic evaluation and graphic display of task run times
- Task related evaluation of function run times
- Statistic evaluation and graphic display of task states
- Task stack coverage
- Task context display
- PRACTICE functions for OS data
- Nucleus PLUS related pull-down menu

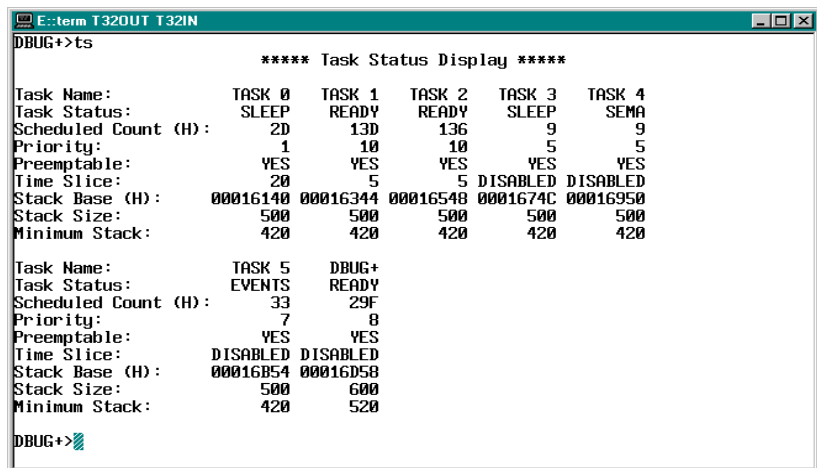
The TRACE32 System includes a configurable multitask debugger to provide symbolic debugging in real time operating systems. Our software package contains a ready-to-run configuration for the Nucleus PLUS Real Time Kernel from Mentor Graphics Corporation.

Multitask Debugging on TRACE32 with Nucleus PLUS

Improved support for the Nucleus PLUS Debugger DBUG+

Nucleus PLUS provides a kernel debugger called DBUG+, which runs on the target. TRACE32 provides an interface to this debugger. I.e. you can control the debugger and view its outputs inside the TRACE32 surface. The communication is set up via the emula-

tor's dual port memory, substituting the serial interface routines of DBUG+. This technique provides high speed, transparent communication with the target without the use of any serial hardware or other target resources.



```

E::term T32OUT T32IN
DEBUG+>ts
***** Task Status Display *****
Task Name:          TASK 0   TASK 1   TASK 2   TASK 3   TASK 4
Task Status:        SLEEP   READY  READY   SLEEP   SEMA
Scheduled Count (H): 2D     13D    136     9        9
Priority:            1       10     10      5        5
Preemptable:        YES     YES    YES     YES     YES
Time Slice:         20      5      5       5       5
Stack Base (H):     00016140 00016344 00016548 0001674C 00016958
Stack Size:         500     500    500     500     500
Minimum Stack:      420     420    420     420     420

Task Name:          TASK 5   DBUG+
Task Status:        EVENTS  READY
Scheduled Count (H): 33     29F
Priority:            7       8
Preemptable:        YES     YES
Time Slice:         DISABLED DISABLED
Stack Base (H):     00016B54 00016D58
Stack Size:         500     600
Minimum Stack:      420     520

DEBUG+>

```

Terminal window to the Nucleus PLUS debugger DBUG+

Task Context Display

The TRACE32 Multitask debugger provides an easy way to switch the current displayed context to another task. Normally all register related windows (e.g. listing at current PC, local variables or function call stack) are displayed

related to the actual context (i.e. current executed task). You can switch to the context of another task to see all this information at the time this task was scheduled.

Real time, non-intrusive display of Nucleus PLUS system resources

The TRACE32 multitask debugger for Nucleus PLUS provides display functions, closely mirroring the command set of DBUG+. The system resources tasks, mailboxes, queues, pipes, semaphores, events, timers, partitions and dynamic memory usage can be displayed. In addition, by using the emulators dual-port memory, the display of all

these regions can be viewed non-intrusively in real time. The tables are updated permanently (“On The Fly”), without affecting the application at all. Moreover, these functions are still available, when the DBUG+ is not linked to your software.

The image shows two windows from the TRACE32 debugger. The top window, titled 'E::task.ts', displays a list of tasks with columns for magic, name, status, schedule, prio, preem, slice, stkbase, and stksize. The bottom window, titled 'E::TASK.TS 140B4', shows a detailed view of a specific task (TASK 5) with columns for signal, handler, mask, and present.

magic	name	status	schedule	prio	preem	slice	stkbase	stksize
00013D6C	TASK 0	SLEEP	00000822	1.	YES	20.	00016140	500.
00013E14	TASK 1	READY	00002600	10.	YES	5.	00016344	500.
00013EBC	TASK 2	RUNNING	000026C0	10.	YES	5.	00016548	500.
00013F64	TASK 3	SLEEP	00000177	5.	YES	DISABL	0001674C	500.
0001400C	TASK 4	SEMA	00000177	5.	YES	DISABL	00016950	500.
000140B4	TASK 5	EVENTS	00000822	7.	YES	DISABL	00016B54	500.
0001415C	DBUG+	SLEEP	00003266	8.	YES	DISABL	00016D58	600.

magic	name	status	schedule	prio	preem	slice	stkbase	stksize
000140B4	TASK 5	EVENTS	00000822	7.	YES	DISABL	00016B54	500.

signal	handler	mask	present
	NONE	00000000	NONE

Task Status list window and detailed window of one specific task

The image shows a window titled 'E::TASK.SS 1424C' displaying semaphore status. It includes columns for magic, name, count, styp, waiting, and first. Below the table, it lists 'waiting tasks'.

magic	name	count	styp	waiting	first
0001424C	SEM 0	00000000	FIFO	1.	TASK 4

waiting tasks
0001400C TASK 4

Semaphore Status window

The image shows a window titled 'E::TASK.DM 14298' displaying dynamic memory pool status. It includes columns for magic, name, start, poolsz, minimum, avail, type, wait, and first. Below the table, it lists 'waiting tasks'.

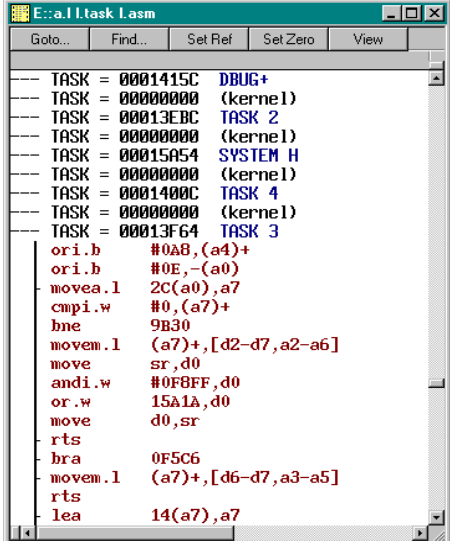
magic	name	start	poolsz	minimum	avail	type	wait	first
00014298	SYSTEM	00016130	4096.	52.	352.	FIFO	0.	NONE

waiting tasks
no task waiting

Dynamic memory pool window

Nucleus PLUS specific display of analyzer listing

The data recorded in the analyzer can be displayed and interpreted specific to the operating system. The task switches can be displayed symbolically.



```

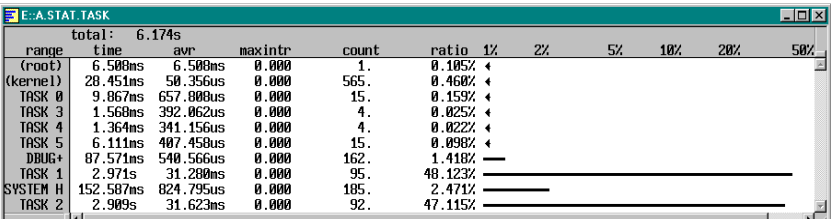
E::a.II.task I.asm
Goto... Find... Set Ref Set Zero View
--- TASK = 0001415C  DEBUG+
--- TASK = 00000000  (kernel)
--- TASK = 00013EBC  TASK 2
--- TASK = 00000000  (kernel)
--- TASK = 00015A54  SYSTEM H
--- TASK = 00000000  (kernel)
--- TASK = 0001400C  TASK 4
--- TASK = 00000000  (kernel)
--- TASK = 00013F64  TASK 3
ori.b    #0A8,(a4)+
ori.b    #0E,-(a0)
movea.l  2C(a0),a7
cmpi.w   #0,(a7)+
bne      9B30
movem.l  (a7)+,[d2-d7,a2-a6]
move     sr,d0
andi.w   #0FBFF,d0
or.w     15A1A,d0
move     d0,sr
rts
bra      0F5C6
movem.l  (a7)+,[d6-d7,a3-a5]
rts
lea      14(a7),a7
  
```

Analyzer listing, task selective recording, display of task switches and assembler mnemonics

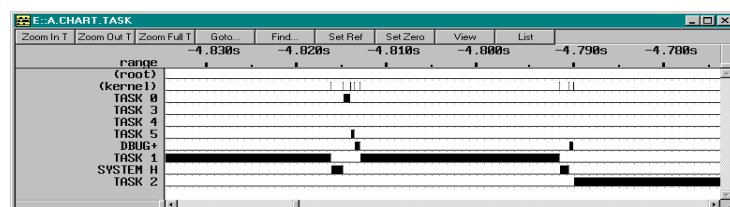
Statistic evaluation and graphic display of task run times

The analyzer can calculate statistic tables of task run times and task switches. A graphical diagram shows

which task was active at a specific time, giving a clear view of the behaviour of the system.



range	time	avr	maxintr	count	ratio	1%	2%	5%	10%	20%	50%
(root)	6.500ms	6.500ms	0.000	1.	0.105%						
(kernel)	28.451ms	50.356us	0.000	565.	0.460%						
TASK 0	9.867ms	657.800us	0.000	15.	0.153%						
TASK 3	1.568ms	392.062us	0.000	4.	0.025%						
TASK 4	1.364ms	341.156us	0.000	4.	0.022%						
TASK 5	6.111ms	407.458us	0.000	15.	0.098%						
DEBUG+	87.571ms	540.566us	0.000	162.	1.418%						
TASK 1	2.971s	31.280ms	0.000	95.	48.123%						
SYSTEM H	152.587ms	824.795us	0.000	105.	2.471%						
TASK 2	2.909s	31.623ms	0.000	92.	47.115%						



Statistics and flow of tasks

Task related evaluation of function run times

The statistic and graphic evaluation of function calls and function run times can be done dependant to the actual running task. This is necessary, if dif-

ferent tasks call one single function at the same time, or if a task switch occurs in between the function.

record	func	ti.func
		TASK = 00000000 (kernel)
		TASK = 0001415C DEBUG+
+007704		
+007705		
+007706		
+007707		
+007708		
+007709		
+007710		
+007711		
+007712		DBT_Put_Char+2 6.750us
+007713		DBT_Put_Char+1E 6.750us
+007714		DBT_Get_Char+2E 3.848ms
+007715		DBC_Input_Line+3C 20.900ms
+007716		DBC_Get_Token+2 61.000us
+007717		DBC_Get_Token+60 61.000us
+007718		DBT_String_Compare+2 59.375us
+007719		strncmp+2 38.625us
+007720		strncmp+36 38.625us
+007721		DBT_String_Compare+24 59.375us
+007722		DBC_Items_Per_Height+2 20.000us
+007723		DBC_Items_Per_Height+20 20.000us
+007724		DBC_Items_Per_Width+2 40.500us
+007725		DBC_Items_Per_Width+22 40.500us

Analyzer listing, function call hierarchy and task switches

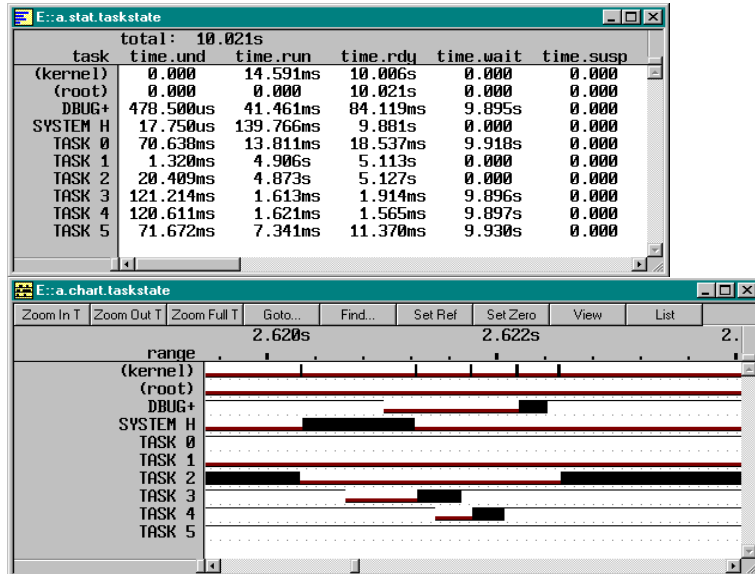
range	tree	time	min	max	avr
	total: 4.099s				
(root)@DEBUG+	(root)@DEBUG+	31.938ms	0.000	31.938ms	31.938ms
_DBC_Items_Per_Width+2@DEBUG+	_DBC_Items_Per_Width+2@DEBUG+	40.500us	40.500us	40.500us	40.500us
DBC_Items_Per_Height+2@DEBUG+	DBC_Items_Per_Height+2@DEBUG+	20.000us	20.000us	20.000us	20.000us
dbc_DBC_Input_Line+3C@DEBUG+	DBC_Input_Line+3C@DEBUG+	20.900ms	20.900ms	20.900ms	20.900ms
mo\dbt_DBT_Get_Char+2@DEBUG+	DBT_Get_Char+2@DEBUG+	20.850ms	3.848ms	16.911ms	6.950ms
mo\dbt_DBT_Put_Char+2@DEBUG+	DBT_Put_Char+2@DEBUG+	20.250us	6.750us	6.750us	6.750us
_DBC_Display_Status+2@DEBUG+	DBC_Display_Status+2@DEBUG+	10.548ms	0.000	10.548ms	10.548ms
mo\dbc_DBC_Get_Name+2@DEBUG+	DBC_Get_Name+2@DEBUG+	27.625us	27.625us	27.625us	27.625us
mo\dbt_DBT_Put_Char+2@DEBUG+	DBT_Put_Char+2@DEBUG+	10.417ms	6.750us	10.403ms	3.472ms

Statistics on function hierarchy, task related

Statistic evaluation and graphic display of task states

These tabular and graphical analyses of the status of tasks show the various states (i.e. running, ready, waiting, suspended and undefined) and times each task spent in each state. A graphical

view of the data can help to highlight prioritisation problems, critical paths etc.

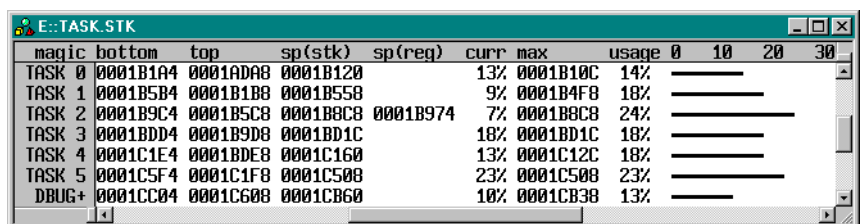


Statistics and flow of task states

Task Stack Coverage

In real time systems it is quite important to know, how much stack space each task consumes. For this purpose

a special window shows the current and the maximum usage of each separate task.



Task stack coverage window

PRACTICE functions for OS data.

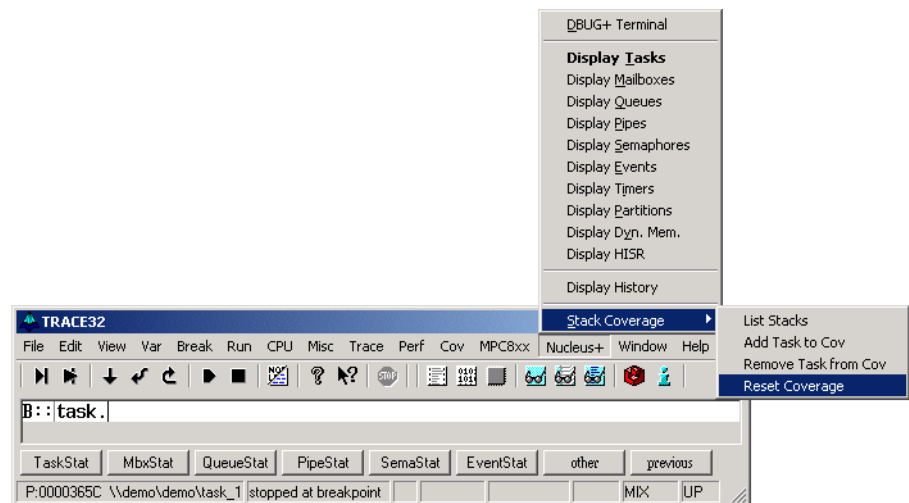
The support includes extended PRACTICE functions for Nucleus PLUS specific data. E.g. the function "TASK.CONFIG(magic)" returns the id

of the so called magic value, which corresponds to the id of the current executed task.

Nucleus PLUS related pull-down menu

Because the menu bar of the TRACE32 user interface can be fully customized, you can create a new pull down menu, including operating system specific commands. We deliver

Nucleus PLUS support with an example for such specific menus, which provides fast access to the Nucleus PLUS features.



TRACE32 with Nucleus PLUS menu

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