实验二

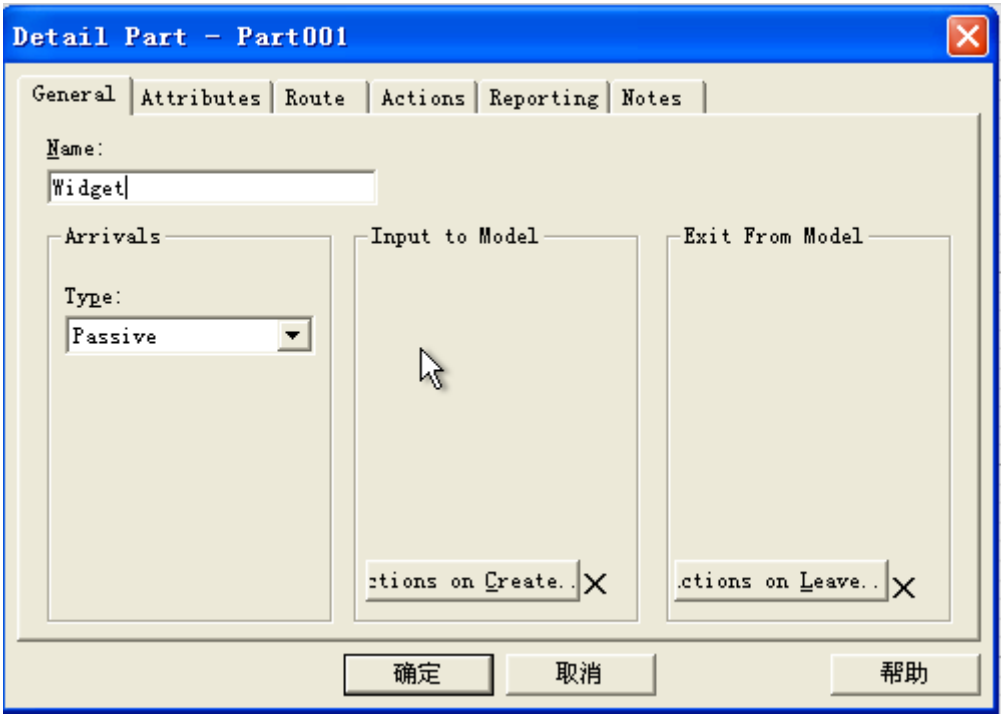
> 实验报告要求
>
> 1. 写出实验目的
> 2. 写出实验步骤（试验阶段及各阶段的简略步骤）
> 3. 列出每一阶段的运行统计表，分析统计表，回答相应问题

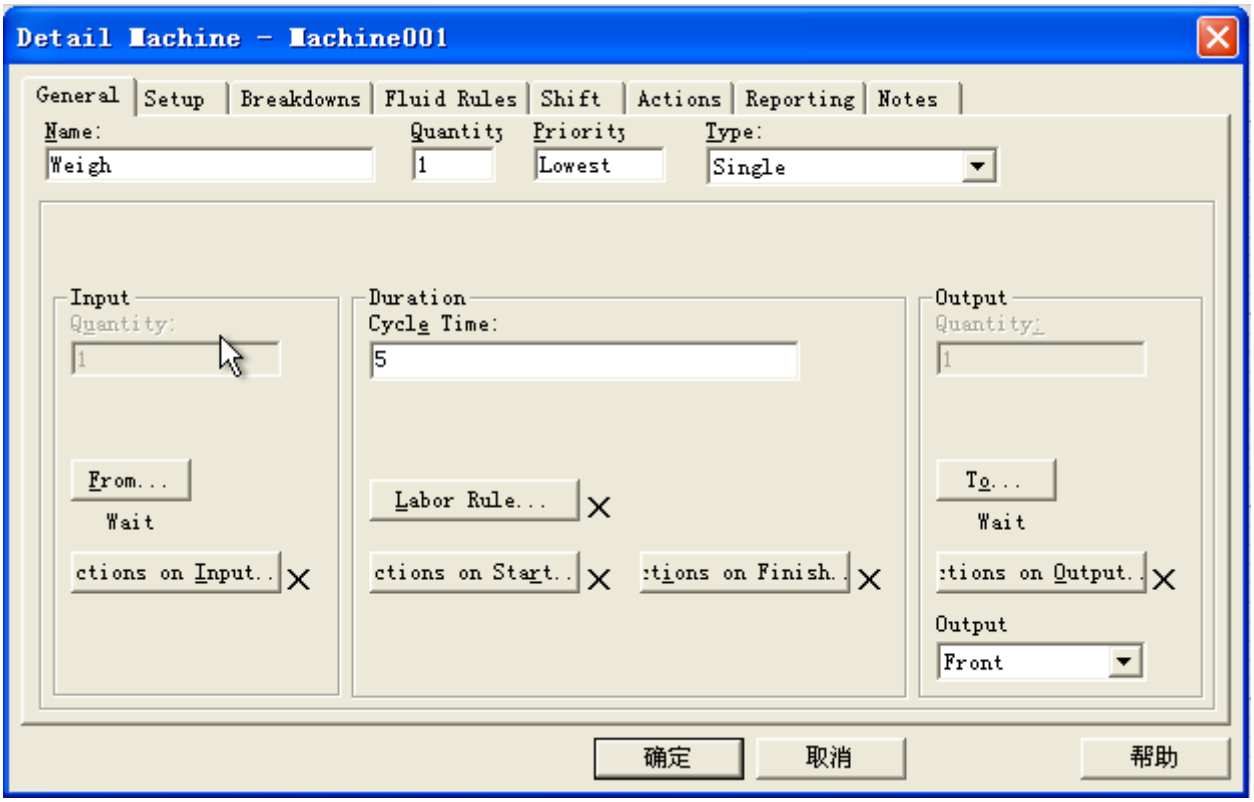
阶段一

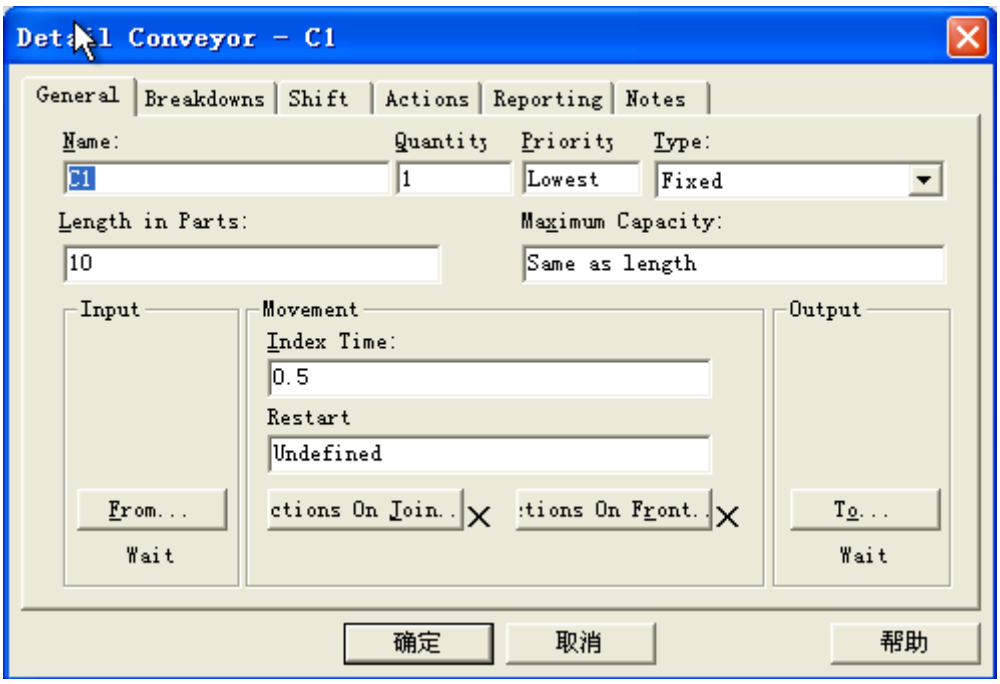
1. 定义模型元素

元素名称	类型	数量	说明
Widget	Part	1	原始零件
Weigh	Machine	1	称重工序
C1	Converyor	1	输送链

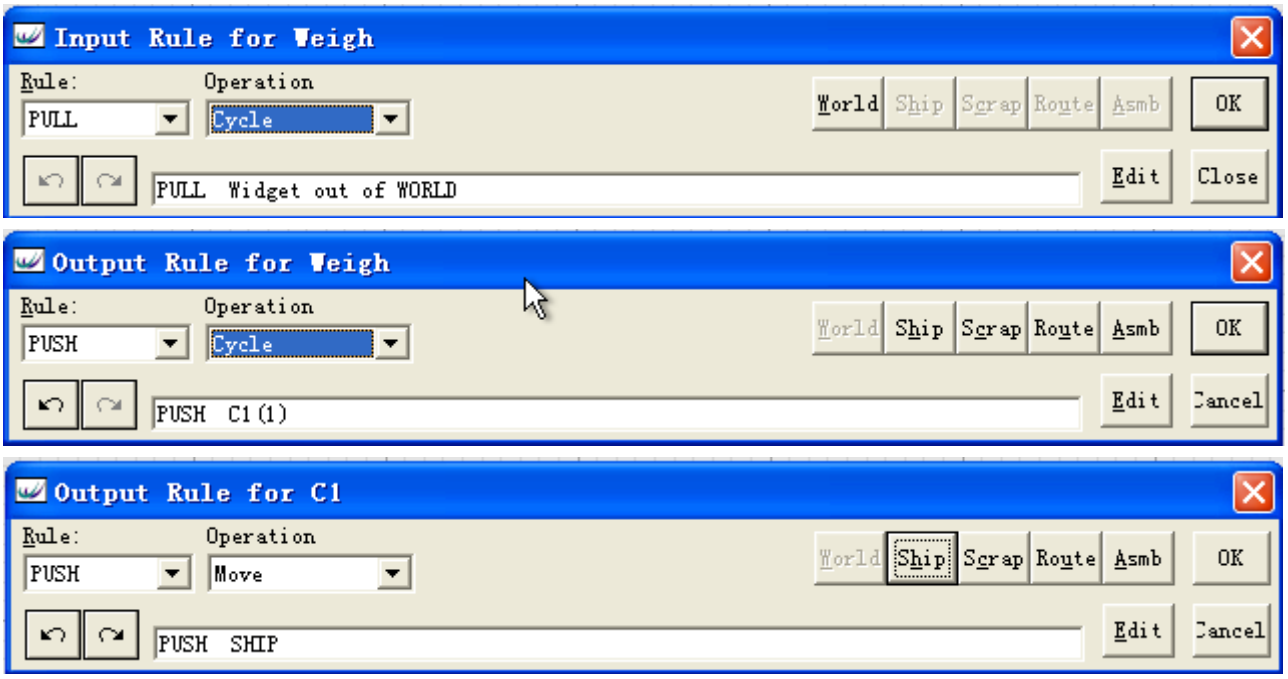
2. 详细定义步骤


Detail Part - Part001
General
Attributes
Route
Actions
Reporting
Notes
Name:
Widget
Arrivals
Type:
Passive
Input to Model
ctions on Create..
Exit From Model
ctions on Leave..
确定
取消
帮助


Detail Machine - Machine001
General
Setup
Breakdowns
Fluid Rules
Shift
Actions
Reporting
Notes
Name:
Weigh
Quantity
1
Priority
Lowest
Type:
Single
Input
Quantity:
1
From...
Wait
ctions on Input..
Duration
Cycle Time:
5
Labor Rule...
ctions on Start..
ctions on Finish..
Output
Quantity:
1
To...
Wait
ctions on Output..
Output
Front
确定
取消
帮助



3. 建立逻辑规则



4. 运行结果与分析

Name	% Idle	% Busy	% Fillin	% Emptying	% Blocked	% Cycle Wait Labor	% Setup	% Setup Wait Labor	% Broken	% Repair Wait	No. Of Operation
Weigh	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20

- 由数据可知，机器Weigh共加工完成了20个零件

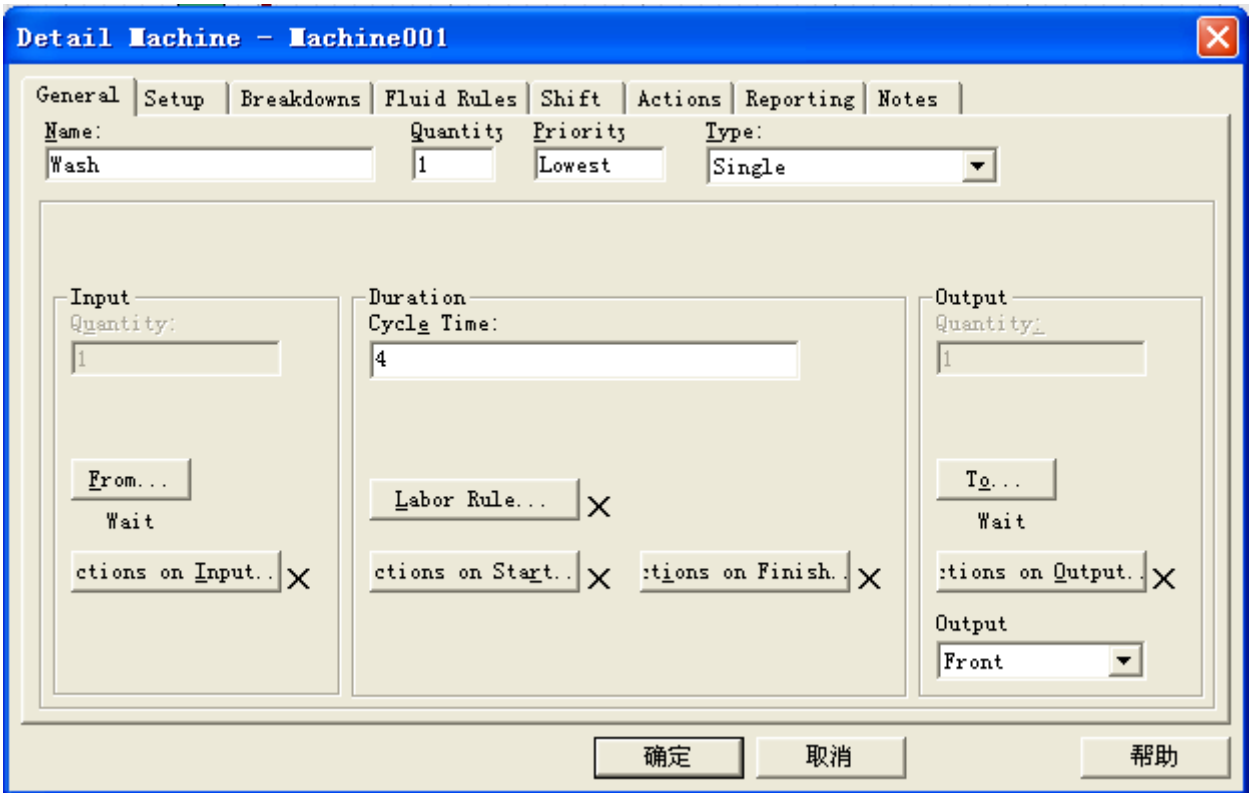
阶段二

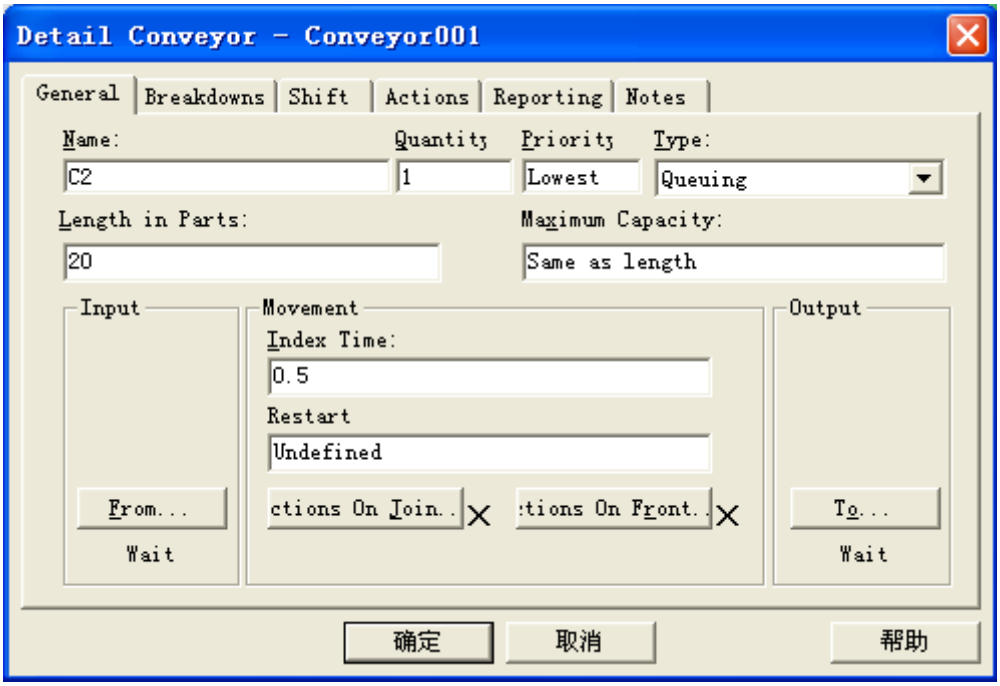
1. 定义模型元素

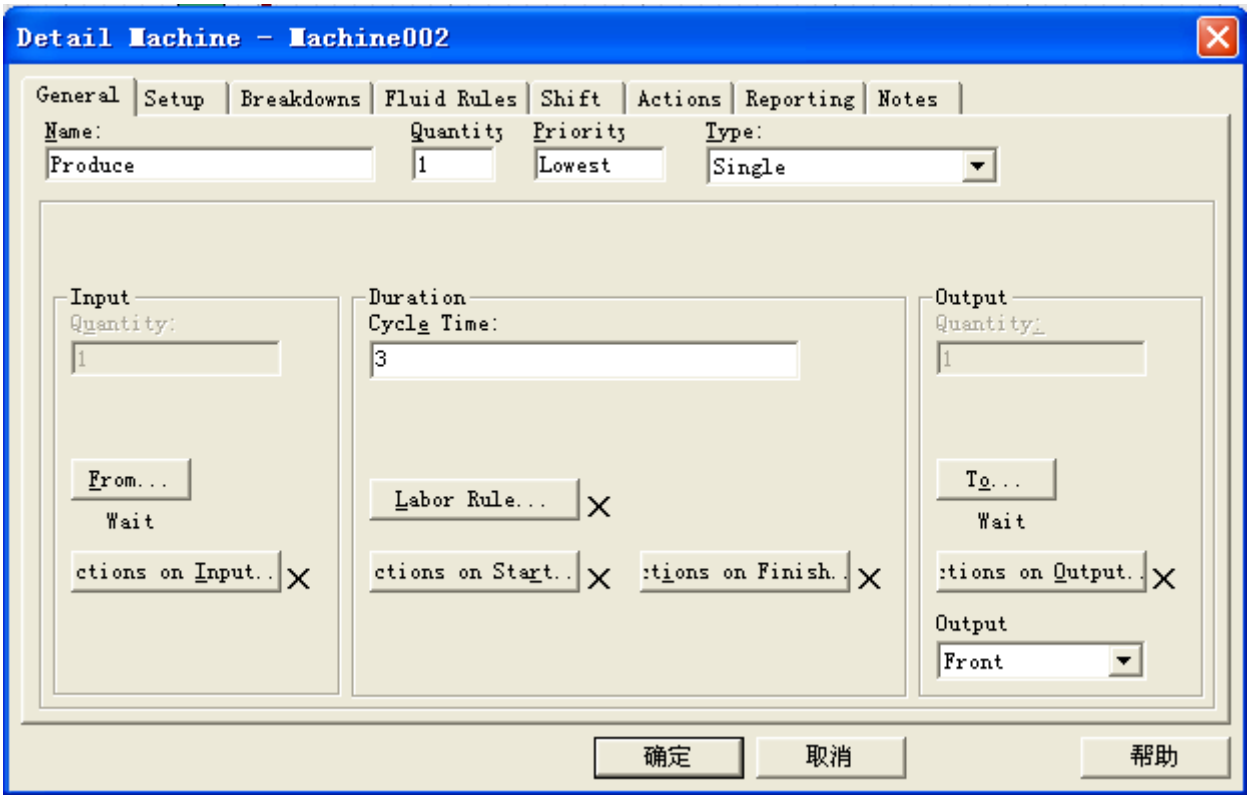
元素名称	类型	数量	说明

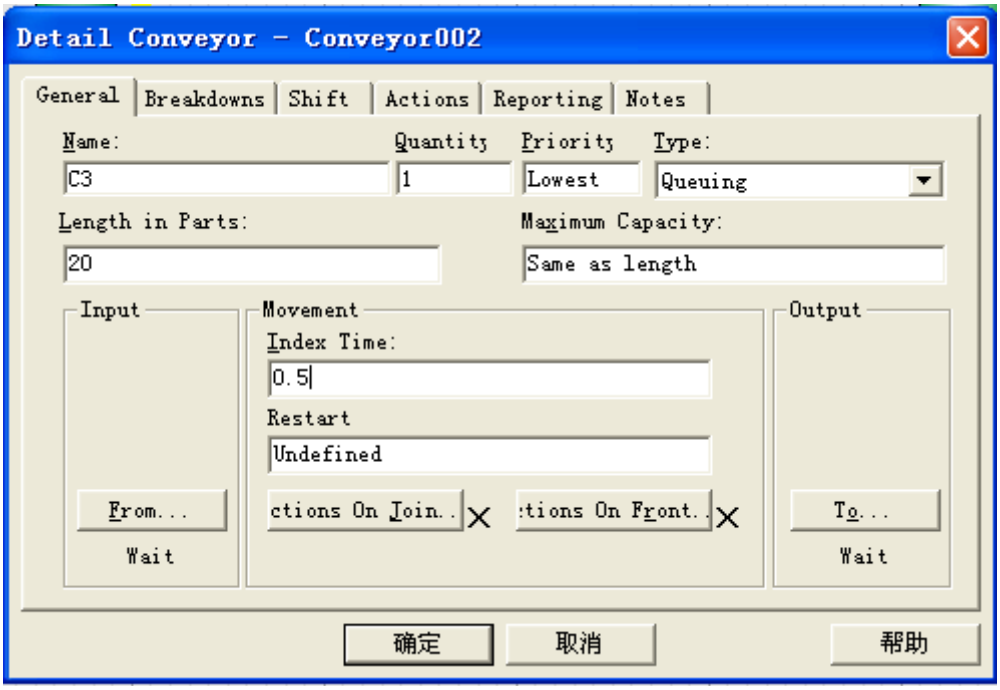
元素名称	类型	数量	说明
Weigh	Machine	1	称重工序
Wash	Machine	1	清洗工序
Produce	Machine	1	加工工序
Inspect	Machine	1	检测工序
C1	Converyor	1	输送链
C2	Converyor	1	输送链
C3	Converyor	1	输送链
Output	Vinteger	1	逻辑元素 动态显示模型中加工完成的小零件的数量

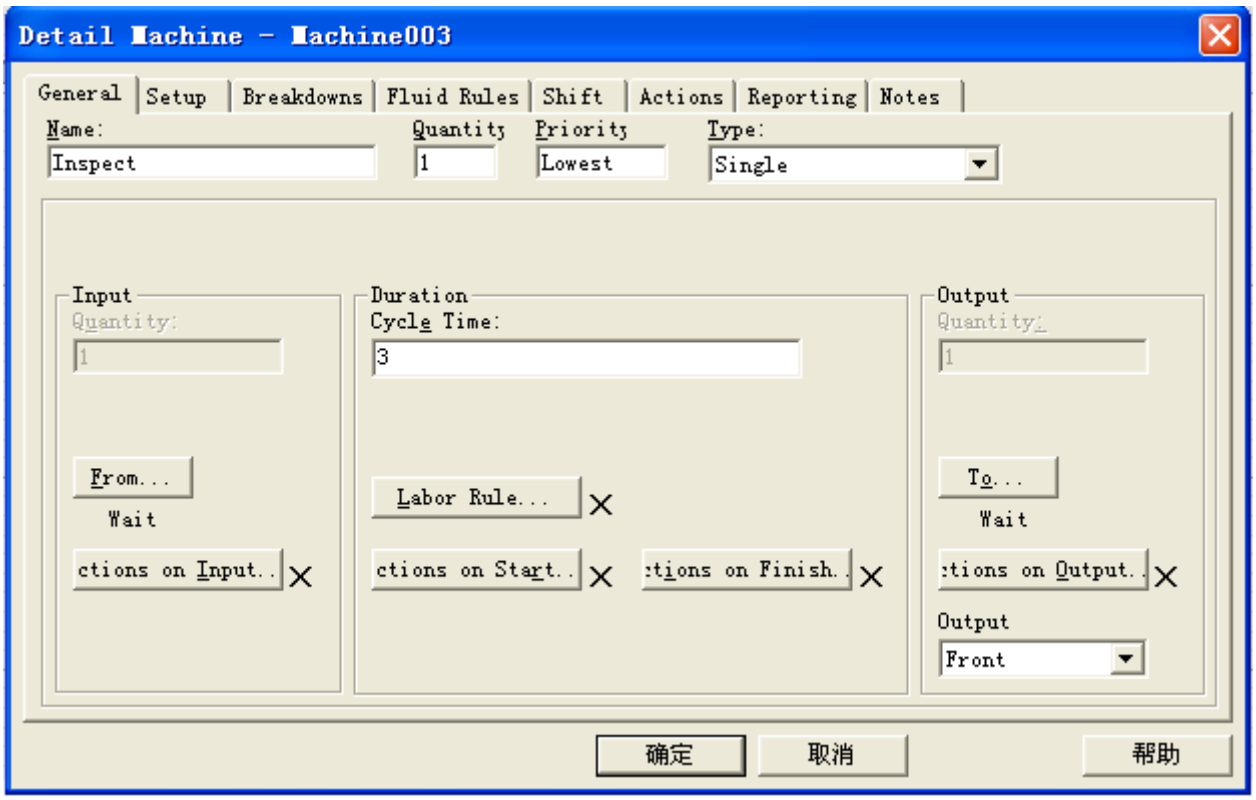
2. 详细定义步骤

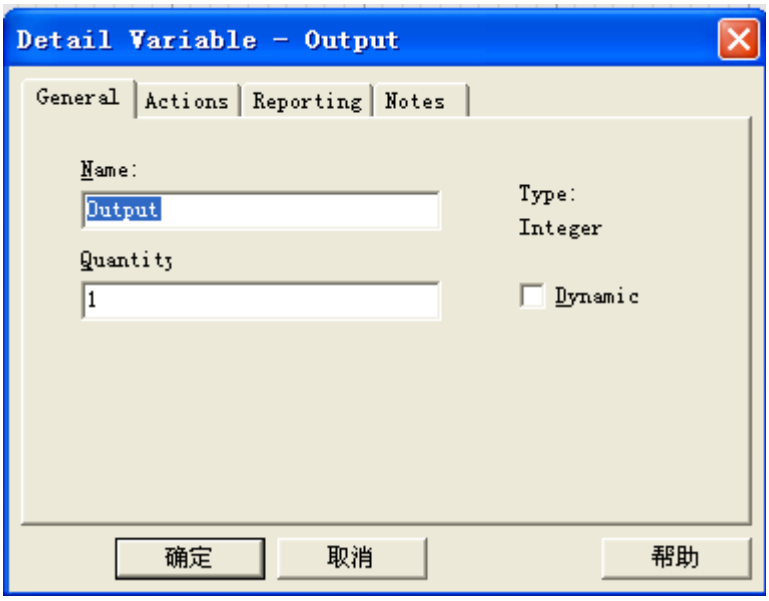

Detail Machine - Machine001
General
Setup
Breakdowns
Fluid Rules
Shift
Actions
Reporting
Notes
Name:
Wash
Quantity
1
Priority
Lowest
Type:
Single
Input
Quantity:
1
From...
Wait
ctions on Input..
Duration
Cycle Time:
4
Labor Rule...
ctions on Start..
tions on Finish..
Output
Quantity:
1
To...
Wait
tions on Output..
Output
Front
确定
取消
帮助

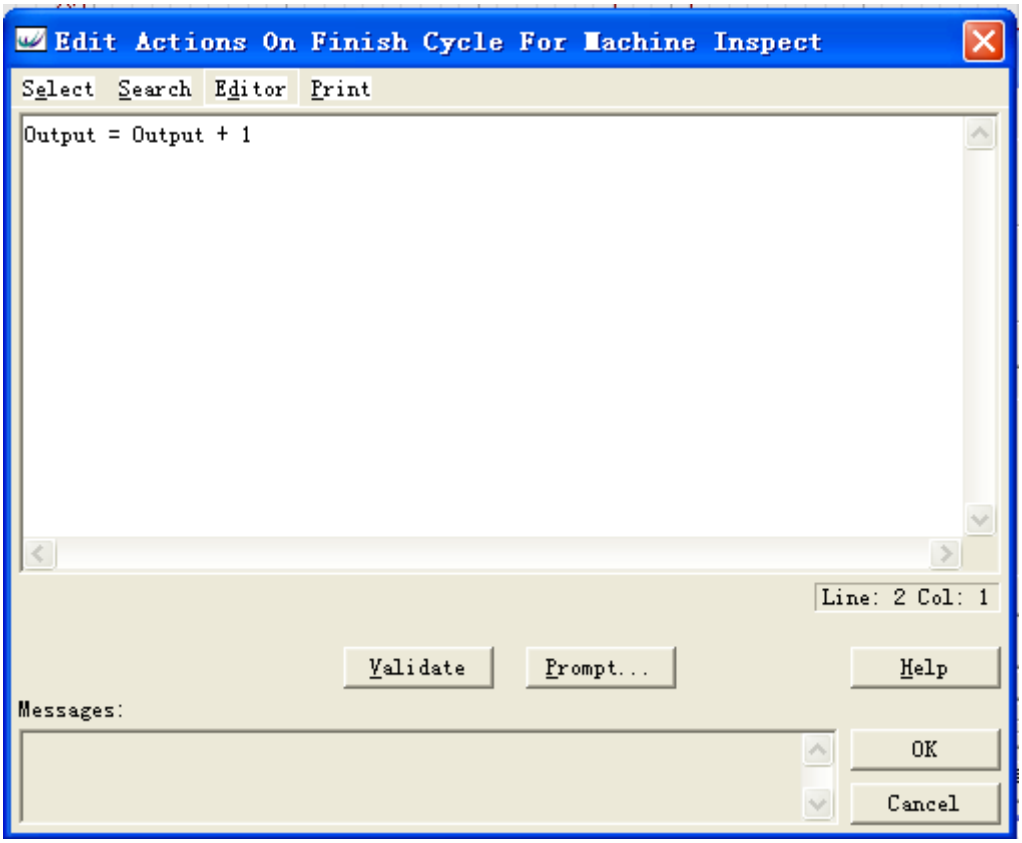

Detail Conveyor - Conveyor001
General
Breakdowns
Shift
Actions
Reporting
Notes
Name:
C2
Quantity
1
Priority
Lowest
Type:
Queuing
Length in Parts:
20
Maximum Capacity:
Same as length
Input
From...
Wait
Movement
Index Time:
0.5
Restart
Undefined
ctions On Join..
tions On Front..
Output
To...
Wait
确定
取消
帮助


Detail Machine - Machine002
General
Setup
Breakdowns
Fluid Rules
Shift
Actions
Reporting
Notes
Name:
Produce
Quantity
1
Priority
Lowest
Type:
Single
Input
Quantity:
1
From...
Wait
ctions on Input..
Duration
Cycle Time:
3
Labor Rule...
ctions on Start..
tions on Finish..
Output
Quantity:
1
To...
Wait
tions on Output..
Output
Front
确定
取消
帮助

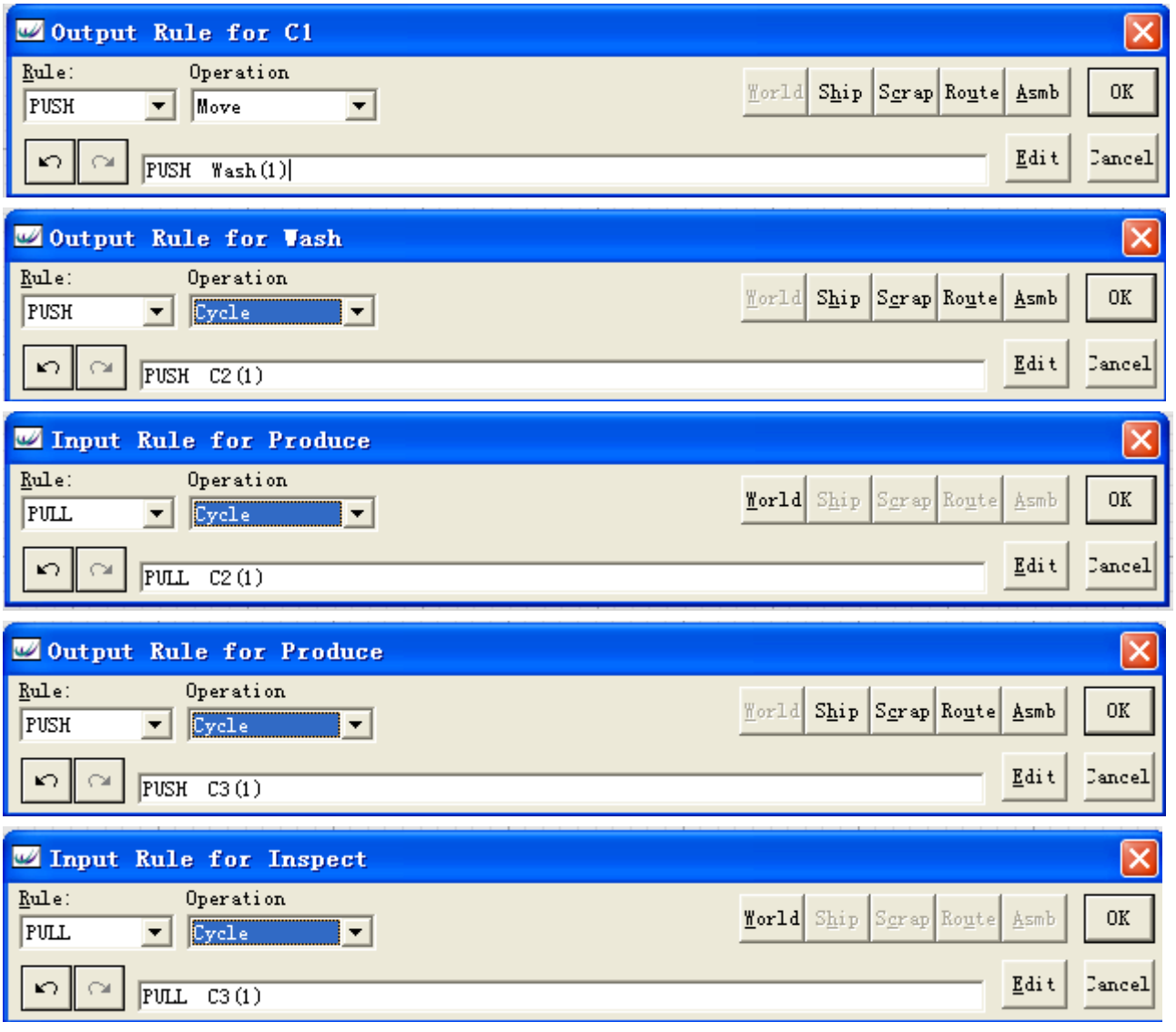

Detail Conveyor - Conveyor002
General
Breakdowns
Shift
Actions
Reporting
Notes
Name:
C3
Quantity
1
Priority
Lowest
Type:
Queuing
Length in Parts:
20
Maximum Capacity:
Same as length
Input
From...
Wait
Movement
Index Time:
0.5
Restart
Undefined
ctions On Join..
tions On Front..
Output
To...
Wait
确定
取消
帮助

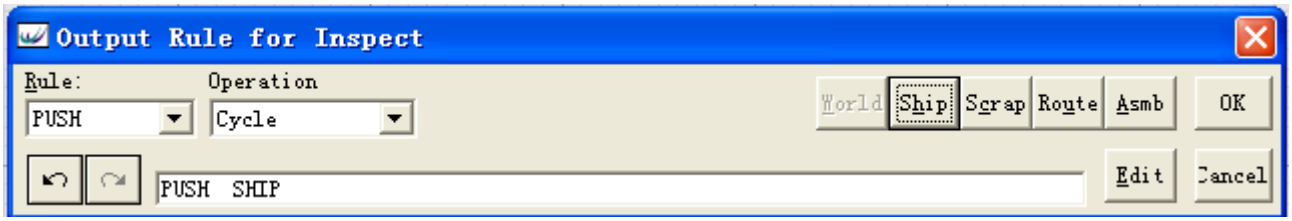

Detail Machine - Machine003
General
Setup
Breakdowns
Fluid Rules
Shift
Actions
Reporting
Notes
Name:
Inspect
Quantity
1
Priority
Lowest
Type:
Single
Input
Quantity:
1
From...
Wait
ctions on Input..
Duration
Cycle Time:
3
Labor Rule...
ctions on Start..
:tions on Finish..
Output
Quantity:
1
To...
Wait
:tions on Output..
Output
Front
确定
取消
帮助

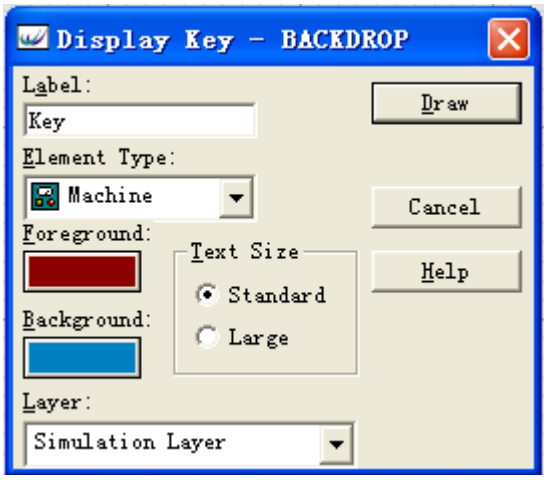

Detail Variable - Output
General
Actions
Reporting
Notes
Name:
Output
Type:
Integer
Quantity
1
Dynamic
确定
取消
帮助

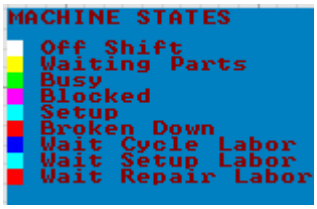

Edit Actions On Finish Cycle For Machine Inspect
Select Search Editor Print
Output = Output + 1
Line: 2 Col: 1
Validate
Prompt...
Help
Messages:
OK
Cancel

3. 建立逻辑规则


Output Rule for C1
Rule:
Operation
PUSH
Move
World Ship Scrap Route Asmb
OK
PUSH Wash(1)
Edit
Cancel
Output Rule for Wash
PUSH
Cycle
PUSH C2(1)
Input Rule for Produce
PULL
Cycle
PULL C2(1)
Output Rule for Produce
PUSH
Cycle
PUSH C3(1)
Input Rule for Inspect
PULL
Cycle
PULL C3(1)







4. 运行结果与分析

Name	% Idle	% Busy	% Fillin	% Emptying	% Blocked	% Cycle Wait Labor	% Setup	% Setup Wait Labor	% Broken	% Repair Wait	No. Of Operation
Weigh	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20
Wash	28.00	72.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18
Produce	54.00	46.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15
Inspect	61.00	39.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13

- 由数据可知，称重工序忙碌率为100%，满负荷运转，所以它是当前运行的“瓶颈”

Name	No. Entere	No. Shippe	No. Scrappe	No. Assembled	No. Rejecte	W.I.P.	Avg W.I.P.	Avg Time	Sigma Rating
Widget	21	13	0	0	0	8	6.60	31.43	6.00

- Widget产生的数据如上图所示

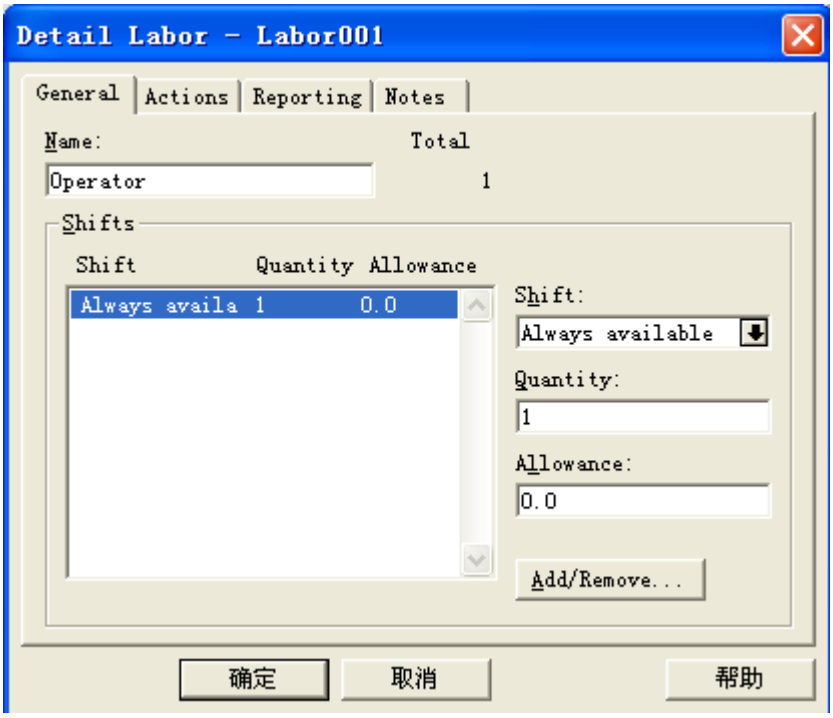
阶段三

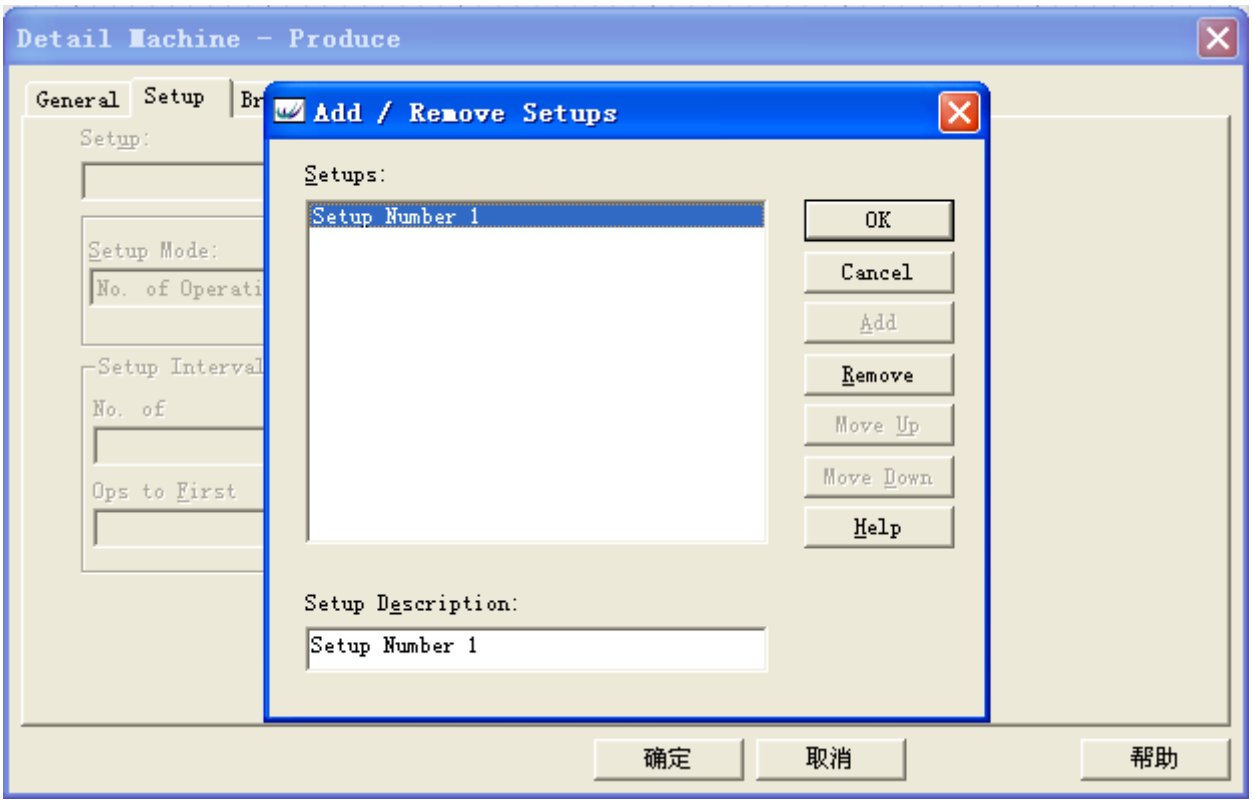
1. 定义模型元素

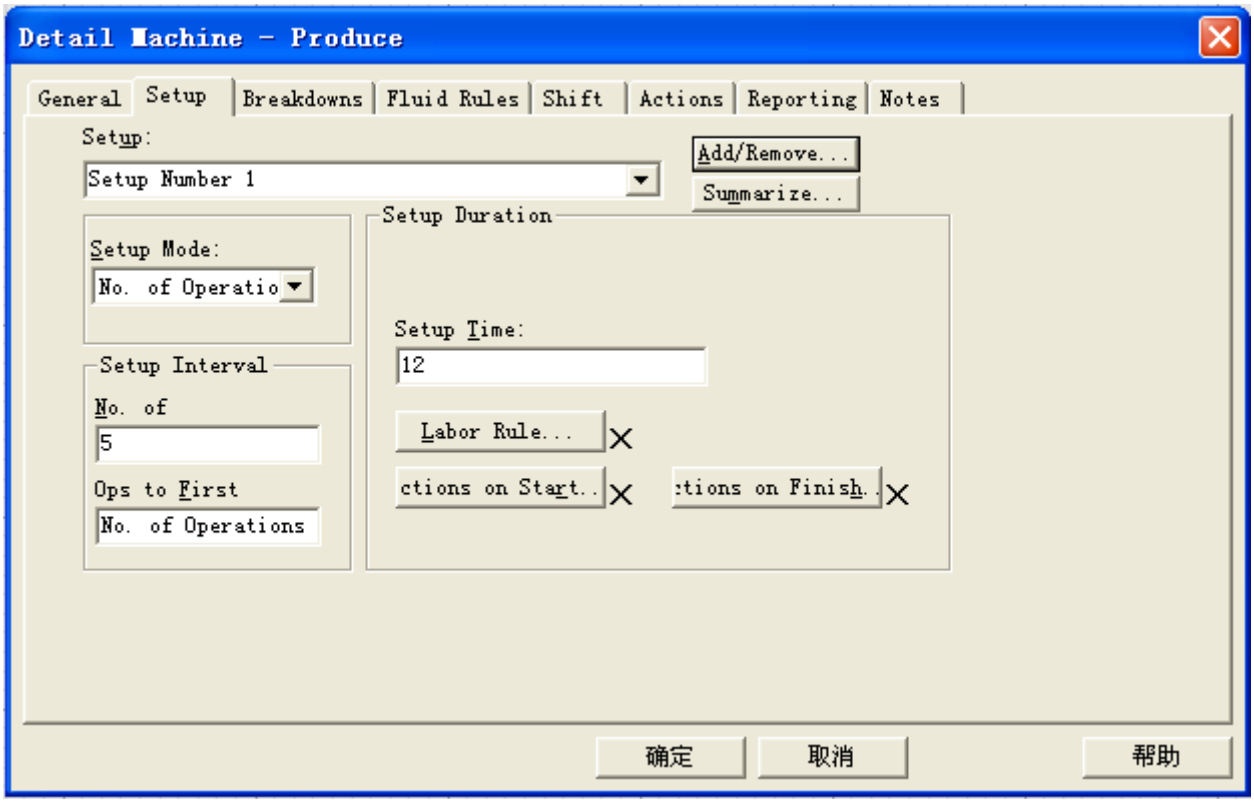
元素名称	类型	数量	说明
Widget	Part	1	原始零件
Weigh	Machine	1	称重工序
Wash	Machine	1	清洗工序
Produce	Machine	1	加工工序
Inspect	Machine	1	检测工序

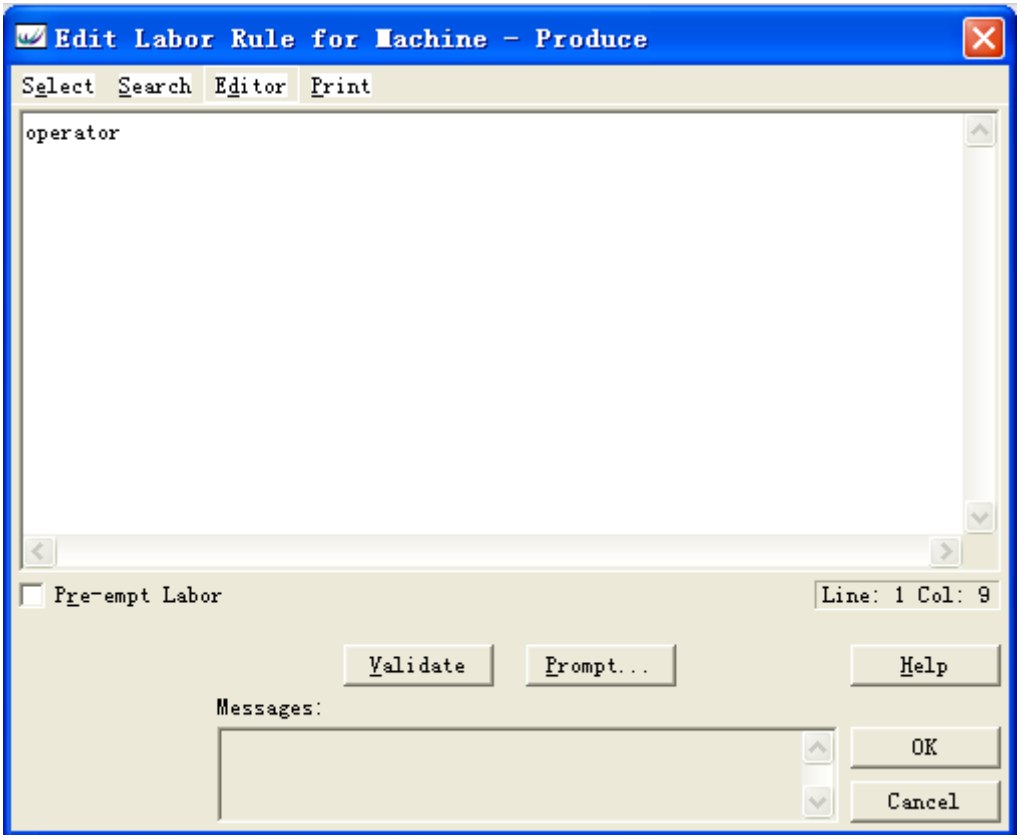
元素名称	类型	数量	说明
C1	Converyor	1	输送链
C2	Converyor	1	输送链
C3	Converyor	1	输送链
Output	Vinteger	1	逻辑元素 动态显示模型中加工完成的小零件的数量
Operator	Labor	1	对加工工序进行刀具调整

2. 详细定义步骤


Detail Labor - Labor001
General
Actions
Reporting
Notes
Name:
Total
Operator
1
Shifts
Shift
Quantity
Allowance
Always availa 1 0.0
Shift:
Always available
Quantity:
1
Allowance:
0.0
Add/Remove...
确定
取消
帮助


Detail Machine - Produce
General
Setup
Setup:
Setup Mode:
No. of Operati
Setup Interval
No. of
Ops to First
Add / Remove Setups
Setups:
Setup Number 1
OK
Cancel
Add
Remove
Move Up
Move Down
Help
Setup Description:
Setup Number 1
确定
取消
帮助





3. 运行结果与分析

- 机器运行数据统计

Name	% Idle	% Busy	% Fillin	% Emptying	% Blocked	% Cycle Wait Labor	% Setup	% Setup Wait Labor	% Broken	% Repair Wait	No. Of Operation
Weigh	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20
Wash	28.00	72.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18
Produce	34.00	42.00	0.00	0.00	0.00	0.00	24.00	0.00	0.00	0.00	14
Inspect	70.00	30.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10

- 输送链运行数据统计

Name	% Empty	% Move	% Blocked	% Queue	% Broken	Now On	Total On	Avg Size	Avg Time
C1	5.00	95.00	0.00	0.00	0.00	1	20	0.95	4.75
C2	14.00	44.00	0.00	42.00	0.00	3	18	2.34	13.00
C3	39.00	61.00	0.00	0.00	0.00	4	14	1.18	8.43

- 劳动者运行数据统计

Name	% Busy	% Idle	Quantity	No. Of Jobs	No. Of Jobs	No. Of Jobs Now	No. Of Jobs	Avg Job
Operator	24.00	76.00	1	2	2	0	0	12.00

- 零件运行数据统计

Name	No. Entere	No. Shippe	No. Scrappe	No. Assembled	No. Rejecte	W.I.P.	Avg W.I.P.	Avg Time	Sigma Rating
Widget	21	10	0	0	0	11	7.15	34.05	6.00

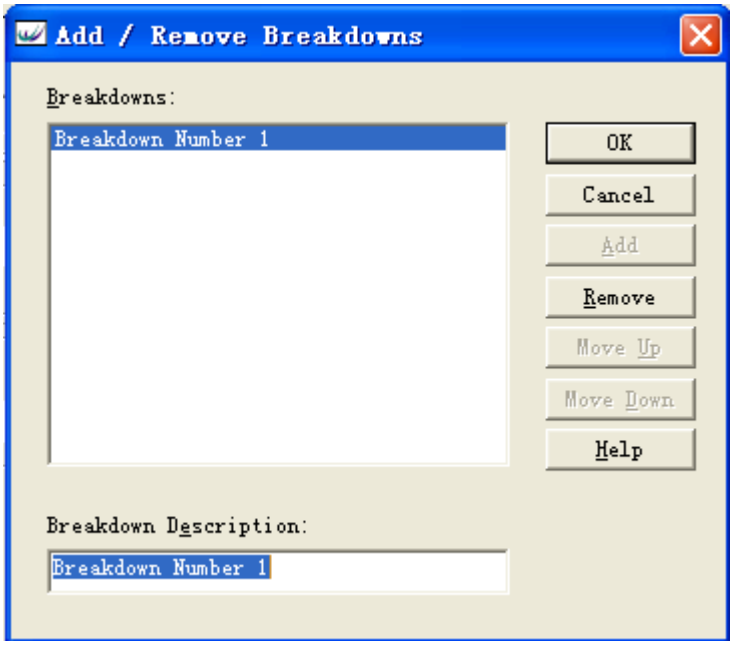
- 分析：通过以上数据可知，称重环节还是处于满负载，因此“瓶颈”仍是称重环节，同时输送链C1移动（忙碌）率为95%，因此在某种程度上来说也是一个“瓶颈”

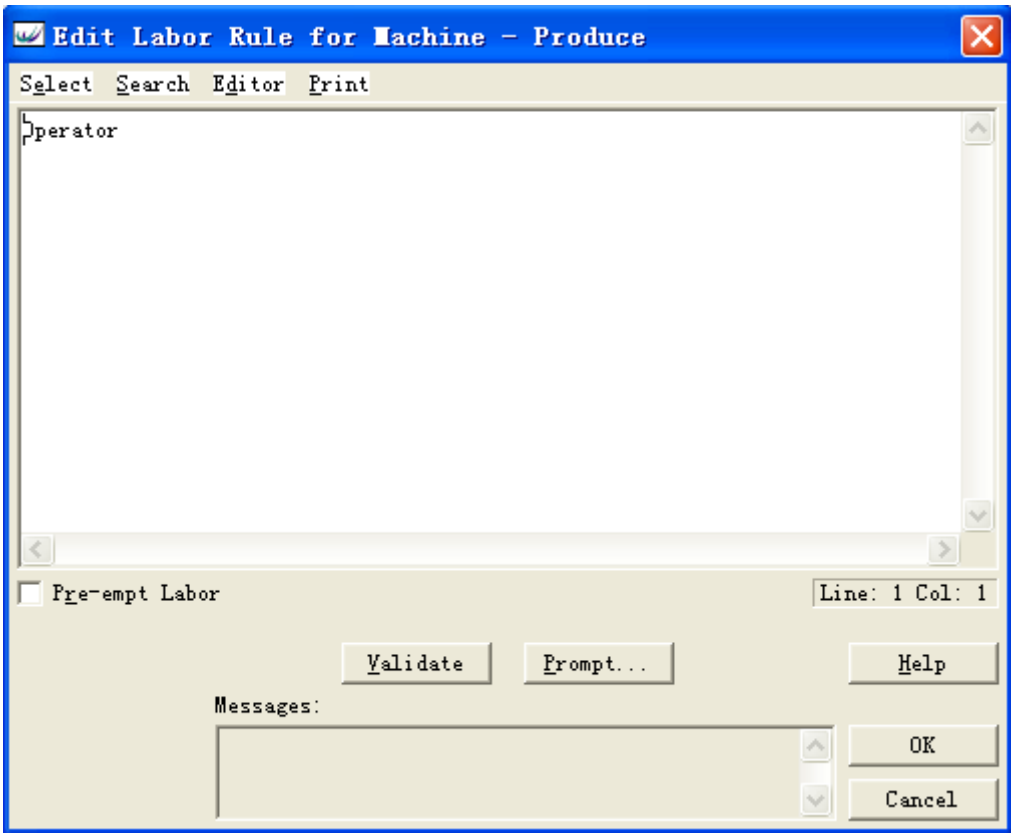
阶段四

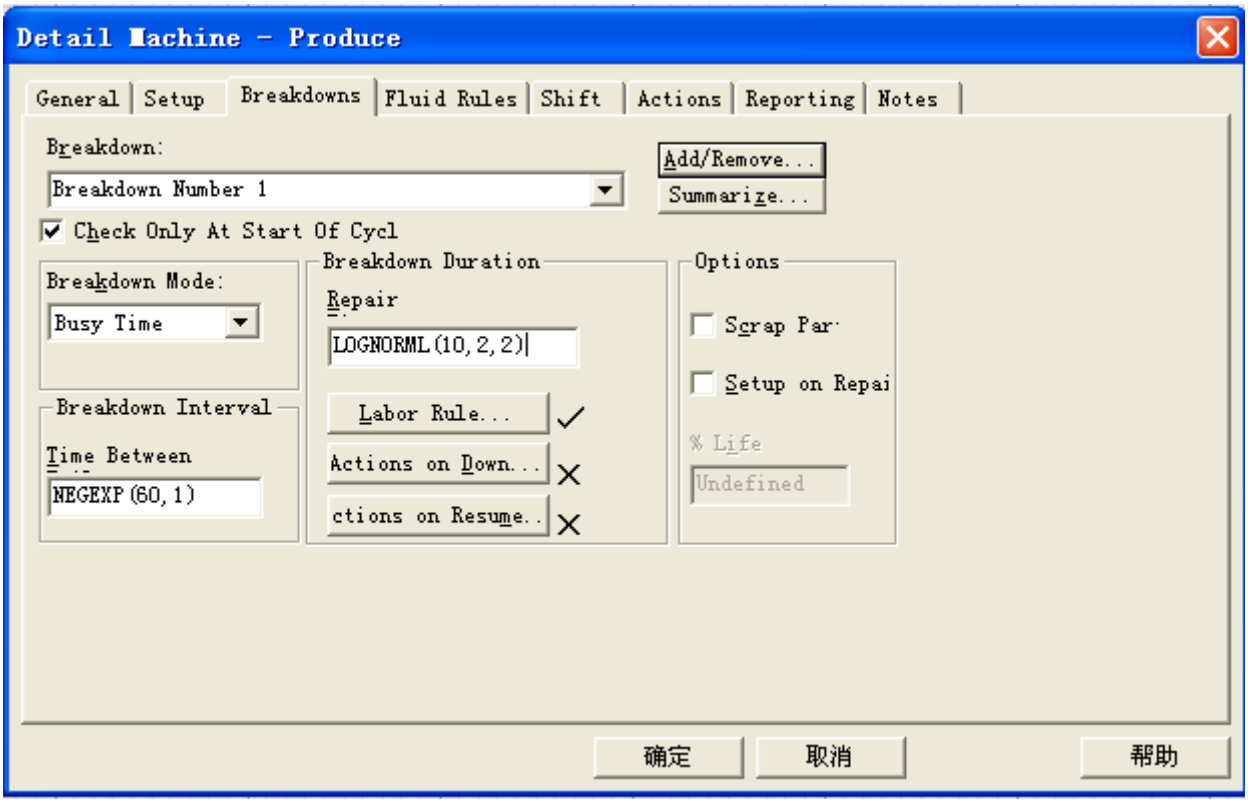
1. 定义模型元素

元素名称	类型	数量	说明
Widget	Part	1	原始零件
Weigh	Machine	1	称重工序
Wash	Machine	1	清洗工序
Produce	Machine	1	加工工序
Inspect	Machine	1	检测工序
C1	Converyor	1	输送链
C2	Converyor	1	输送链
C3	Converyor	1	输送链
Output	Vinteger	1	逻辑元素 动态显示模型中加工完成的小零件的数量
Operator	Labor	1	对加工工序进行刀具调整

2. 详细定义步骤


Add / Remove Breakdowns
Breakdowns:
Breakdown Number 1
OK
Cancel
Add
Remove
Move Up
Move Down
Help
Breakdown Description:
Breakdown Number 1


Edit Labor Rule for Machine - Produce
Select Search Editor Print
Operator
Pre-empt Labor
Line: 1 Col: 1
Validate
Prompt...
Help
Messages:
OK
Cancel



3. 运行结果与分析

- 机器运行数据统计

Name	% Idle	% Busy	% Fillin	% Emptying	% Blocked	% Cycle Wait Labor	% Setup	% Setup Wait Labor	% Broken	% Repair Wait	No. Of Operation
Weigh	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100
Wash	21.60	78.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	98
Produce	6.80	48.00	0.00	0.00	0.00	0.00	37.40	0.00	7.80	0.00	80
Inspect	53.20	46.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	77

- 输送链运行数据统计

Name	% Empty	% Move	% Blocked	% Queue	% Broken	How On	Total On	Avg Size	Avg Time
C1	1.00	99.00	0.00	0.00	0.00	1	100	0.99	4.95
C2	2.80	9.00	0.00	88.20	0.00	17	98	8.30	42.35
C3	25.80	74.20	0.00	0.00	0.00	2	80	1.59	9.96

- 劳动者运行数据统计

Name	% Busy	% Idle	Quanti ty	No. Of Jobs	No. Of Jobs	No. Of Jobs How	No. Of Jobs	Avg Job
Operator	45.20	54.80	1	20	19	1	0	11.53

- 零件运行数据统计

Name	No. Entere	No. Shippe	No. Scrappe	No. Assembled	No. Rejecte	W.I.P.	Avg W.I.P.	Avg Time	Sigma Rating
Widget	101	77	0	0	0	24	14.07	69.65	6.00

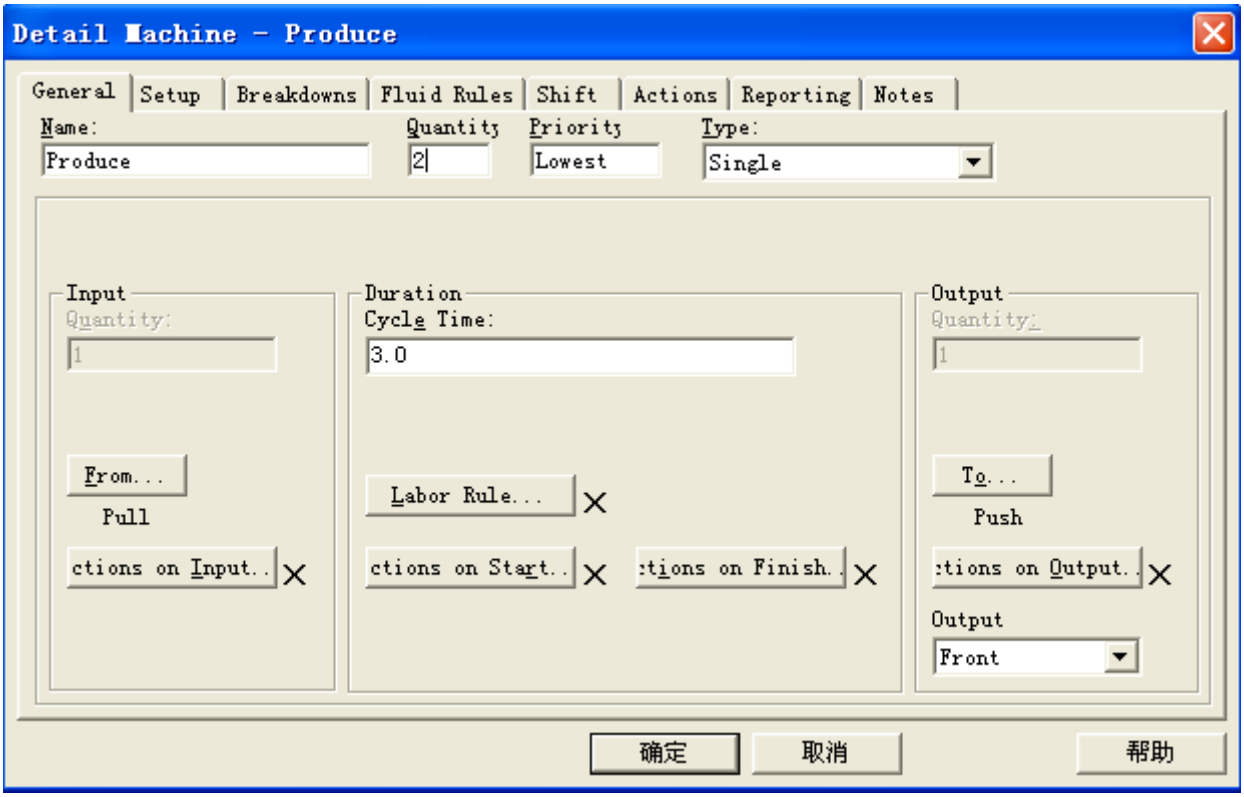
- 分析：通过对比阶段四和阶段三的运行数据，可发现几点变化
  1. 在机器运行方面，加工工序开始有了随机机器故障率（7.8%），因此机器的维修率对比阶段四有了明显的增加（从24%到37.4%），故机器的空闲率有了明显的下降（从34%到6.8%）；检查工序的忙碌率有了明显的增长（从30%到46.8%）
  2. 在输送链运行方面，阶段四和阶段五基本无变化
  3. 在劳动者运行方面，劳动者的忙碌率增加量近乎一倍（从24%到45.2%），这是因为机器有了随机故障率，需要劳动者进行维修
  4. 在零件运行方面，平均在制品库存（Avg W.I.P）增加了一倍（从7.15到14.07），平均逗留时间（Avg Time）增加了一倍（从34.05到69.65）

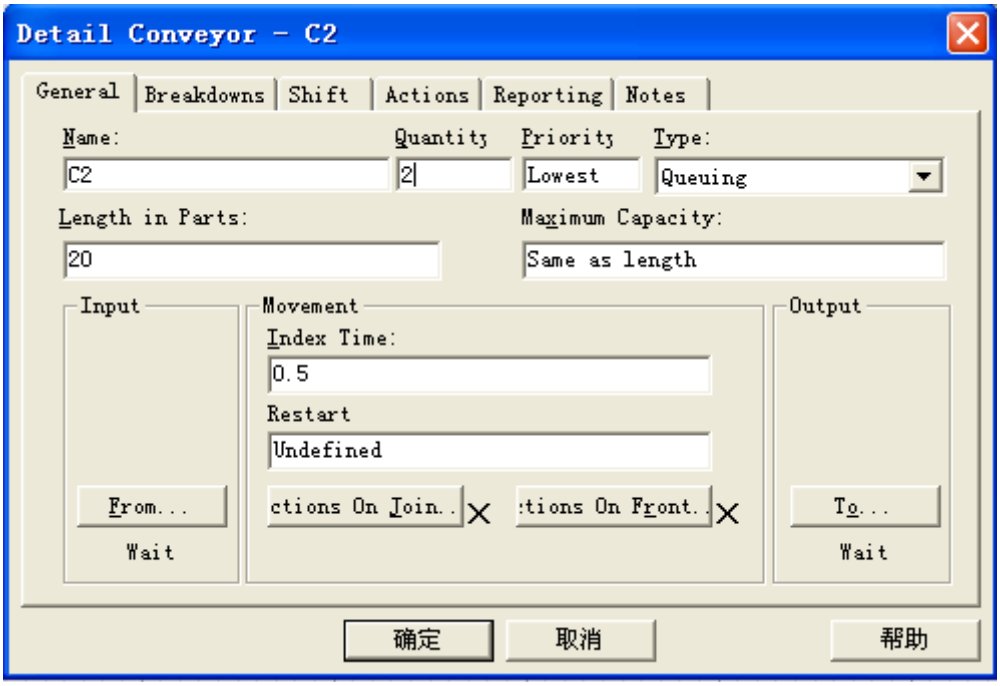
阶段五

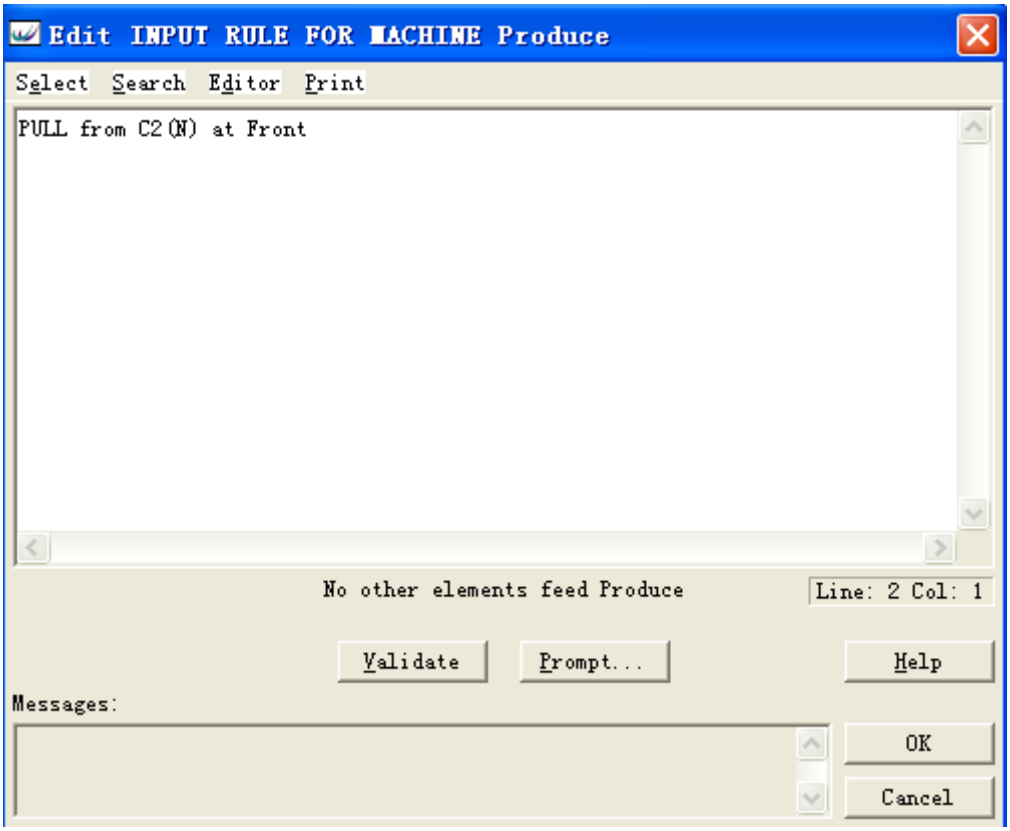
1. 定义模型元素

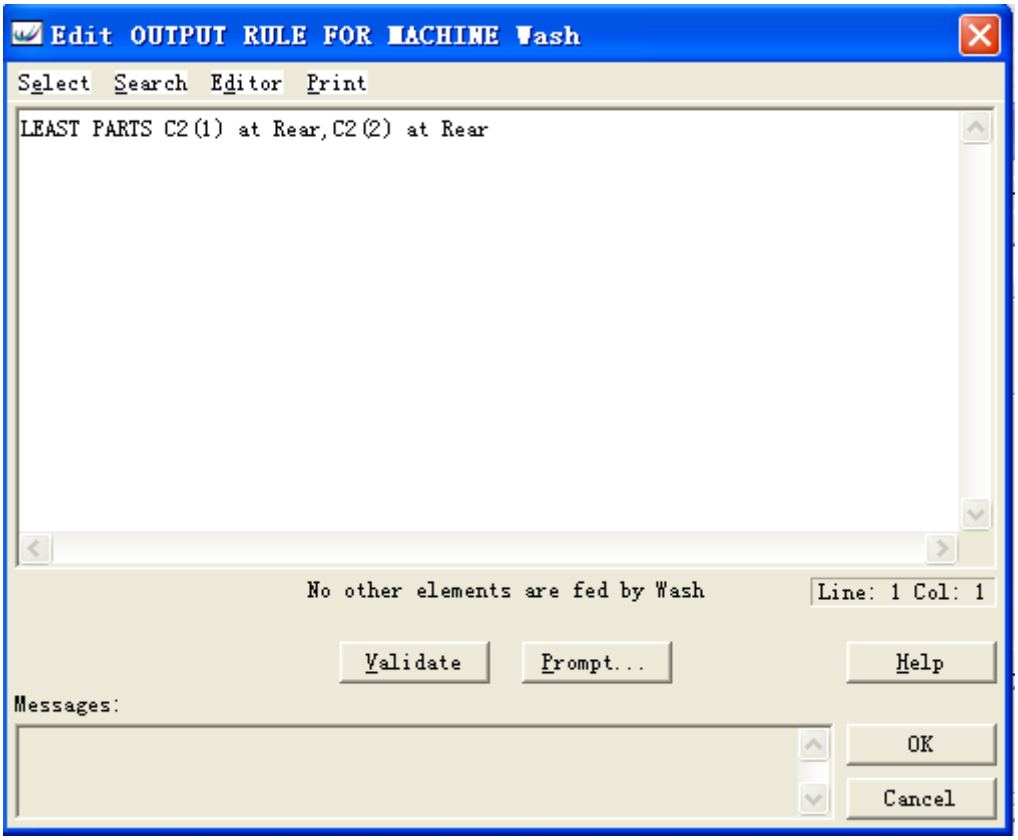
元素名称	类型	数量	说明
Widget	Part	1	原始零件
Weigh	Machine	1	称重工序
Wash	Machine	1	清洗工序
Produce	Machine	2	加工工序
Inspect	Machine	1	检测工序
C1	Converyor	1	输送链
C2	Converyor	2	输送链
C3	Converyor	1	输送链
Output	Vinteger	1	逻辑元素 动态显示模型中加工完成的小零件的数量
Operator	Labor	1	对加工工序进行刀具调整

2. 详细定义步骤


Detail Machine - Produce
General
Setup
Breakdowns
Fluid Rules
Shift
Actions
Reporting
Notes
Name:
Produce
Quantity
2
Priority
Lowest
Type:
Single
Input
Quantity:
1
From...
Pull
ctions on Input..
Duration
Cycle Time:
3.0
Labor Rule...
ctions on Start..
:tions on Finish..
Output
Quantity:
1
To...
Push
:tions on Output..
Output
Front
确定
取消
帮助


Detail Conveyor - C2
General
Breakdowns
Shift
Actions
Reporting
Notes
Name:
C2
Quantity
2
Priority
Lowest
Type:
Queuing
Length in Parts:
20
Maximum Capacity:
Same as length
Input
From...
Wait
Movement
Index Time:
0.5
Restart
Undefined
ctions On Join..
:tions On Front..
Output
To...
Wait
确定
取消
帮助





3. 运行结果与分析

- 机器运行数据统计

Name	% Idle	% Busy	% Fillin	% Emptying	% Blocked	% Cycle Wait Labor	% Setup	% Setup Wait Labor	% Broken	% Repair Wait	No. Of Operation
Weigh	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100
Wash	21.60	78.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	98
Produce(1)	36.99	32.00	0.00	0.00	0.10	0.00	24.00	3.01	3.89	0.00	53
Produce(2)	48.99	24.00	0.00	0.00	0.11	0.00	19.00	2.20	3.91	1.80	40
Inspect	45.00	55.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	91

- 输送链运行数据统计

Name	% Empty	% Move	% Blocked	% Queue	% Broken	Now On	Total On	Avg Size	Avg Time
C1	1.00	99.00	0.00	0.00	0.00	1	100	0.99	4.95
C2(1)	4.90	63.60	0.00	31.50	0.00	1	55	1.46	13.26
C2(2)	20.00	68.50	0.00	11.50	0.00	2	43	0.98	11.37
C3	14.90	71.60	0.00	13.50	0.00	1	93	2.00	10.77

- 劳动者运行数据统计

Name	% Busy	% Idle	Quantity	No. Of Jobs	No. Of Jobs	No. Of Jobs Now	No. Of Jobs	Avg Job
Operator	50.80	49.20	1	22	21	1	0	11.57

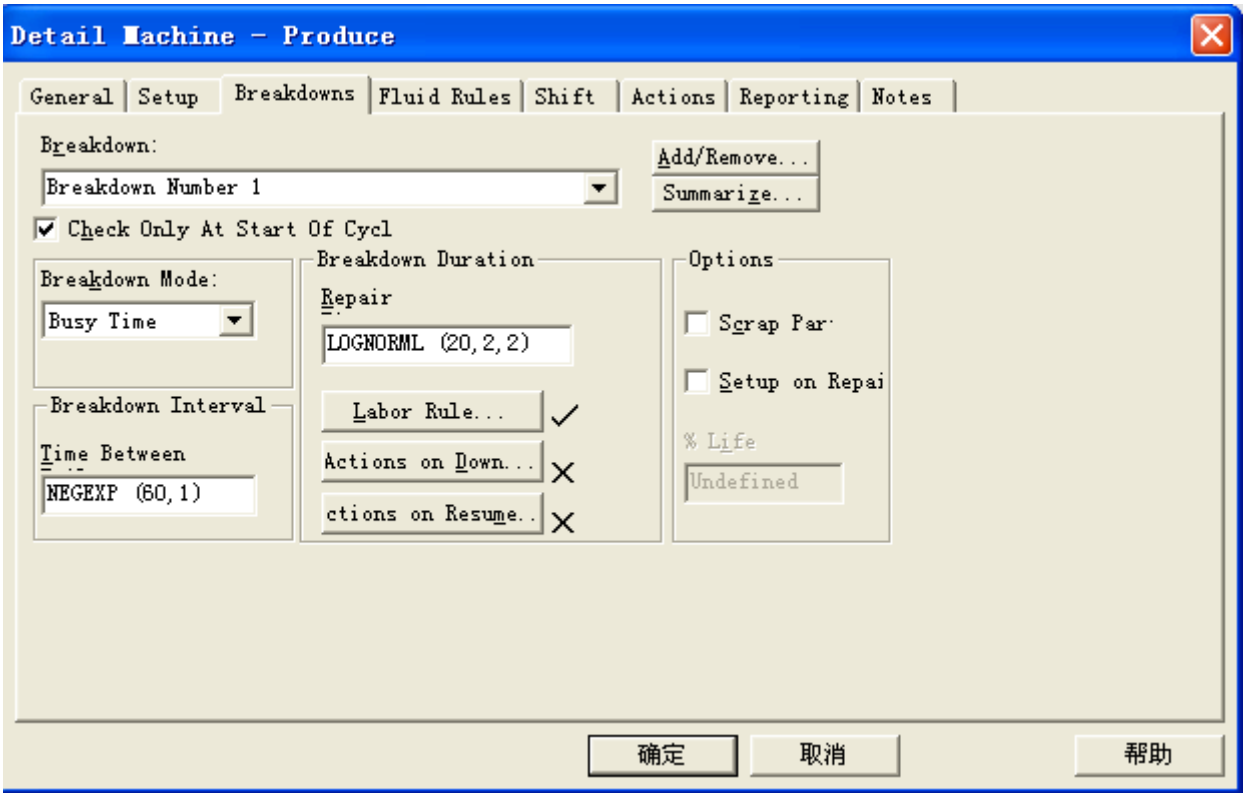
- 零件运行数据统计

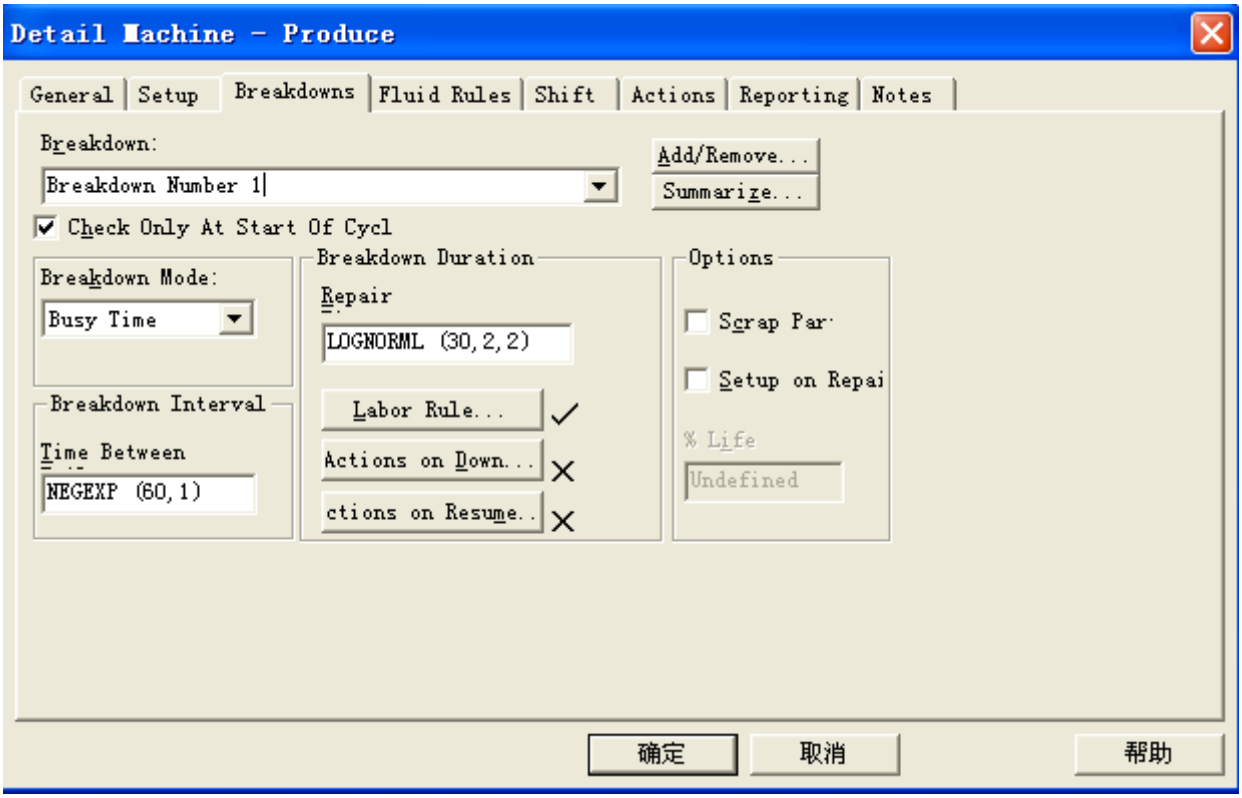
Name	No. Entere	No. Shippe	No. Scrappe	No. Assembled	No. Rejecte	W.I.P.	Avg W.I.P.	Avg Time	Sigma Rating
Widget	101	91	0	0	0	10	8.90	44.08	6.00

- 分析：通过对比阶段五和阶段四的运行数据，可发现几点变化
  1. 在机器运行方面，由于阶段五的加工机器从一台增加到了两台，两台加工机器交替工作，故阶段五中加工机器的空闲率较阶段四都有所提高，忙碌率都有所下降；同时由于是两台机器交替工作，故阶段四中的加工机器的故障率在阶段五中均摊到了两台加工机器中，继而导致维修率也分摊到了两台机器上；加工工序的操作总数也有了增加
  2. 在输送链运行方面，由于增加了一条C2输送链，C2输送链的排队率有了非常明显降低（从88.2%到21%（两台输送链平均）），同时忙碌率也有了非常明显的提升（从9%到65%）
  3. 在劳动者运行方面，阶段五与阶段四相差无几
  4. 在零件运行方面，阶段五与阶段四相差无几

阶段六

1. 主要设置步骤





2. 运行结果与分析

Name	No. Entere	No. Shippe	No. Scrappe	No. Assembled	No. Rejecte	W.I.P.	Avg W.I.P.	Avg Time	Sigma Rating
Widget	101	92	0	0	0	9	9.38	46.44	6.00

Name	No. Entere	No. Shippe	No. Scrappe	No. Assembled	No. Rejecte	W.I.P.	Avg W.I.P.	Avg Time	Sigma Rating
Widget	101	92	0	0	0	9	10.72	53.09	6.00

- 分析：通过对比零件产出量在不同维修时间均值下的变化，可以发现零件产出量变化很小